Journal of the Royal Society of Arts

NO. 5032 MARCH 1959 VOL. CVII

FORTHCOMING MEETINGS

MONDAY, 2ND MARCH, at 6 p.m. The first of three CANTOR LECTURES on '*The Classical Country House in Eighteenth-Century England*', by Sir John Summerson, C.B.E., A.R.I.B.A., F.B.A., F.S.A., Curator, Sir John Soane's Museum. (A syllabus of the Lectures—which will be illustrated with lantern slides—appears on page 226.)

WEDNESDAY, 4TH MARCH, at 2.30 p.m. '*The Future of Nash Terraces*', by Richard H. Davies, A.A.Dip., F.R.I.B.A. Sir Thomas Bennett, K.B.E., F.R.I.B.A., will preside. (The paper will be illustrated by lantern slides.)

THURSDAY, 5TH MARCH, at 5.15 p.m. COMMONWEALTH SECTION. '*The Art of the Australian Aborigines and its Place in their Lives*', by Charles Mountford, O.B.E., F.R.A.I. Sir Hugh Casson, R.D.I., M.A., F.R.I.B.A., will preside. (The paper will be illustrated by lantern slides and a film. Tea will be served in the Library from 4.30 p.m.)

MONDAY, 9TH MARCH, at 6 p.m. The second of three CANTOR LECTURES on '*The Classical Country House in Eighteenth-Century England*', by Sir John Summerson.

WEDNESDAY, 11TH MARCH, at 2.30 p.m. '*Some Achievements of the International Geophysical Year*', by D. C. Martin, B.Sc., Ph.D., F.R.I.C., F.R.S.E., Assistant Secretary, the Royal Society. The Right Honble. Lord Nathan, P.C., T.D., D.L., J.P., F.S.A., President, Royal Geographical Society, and a Member of Council of the Royal Society of Arts, will preside. (The paper will be illustrated by lantern slides.)

FRIDAY, 13TH MARCH, at 7.30 p.m. FILM EVENING. (See programme on page 226.)

MONDAY, 16TH MARCH, at 6 p.m. The last of three CANTOR LECTURES on '*The Classical Country House in Eighteenth-Century England*', by Sir John Summerson.

TUESDAY, 17TH MARCH, at 5.15 p.m. COMMONWEALTH SECTION. SIR GEORGE

BIRDWOOD MEMORIAL LECTURE. '*A Century of British Education in India, 1857–1957*', by Professor M. S. Sundaram, Education Counsellor, Office of the High Commissioner for India. (Tea will be served in the Library from 4.30 p.m.)

WEDNESDAY, 18TH MARCH, at 2.30 p.m. '*A Study of the Pollution of the Thames Estuary*', by B. A. Southgate, C.B.E., Ph.D., D.Sc., Director, Water Pollution Research, D.S.I.R. Herbert W. Cremer, C.B.E., M.Sc., F.R.I.C., Chairman, Thames Survey Committee, will preside.

WEDNESDAY, 15TH APRIL, at 2.30 p.m. FERNHURST LECTURE. '*The Biological Control of Agricultural Pests*', by G. C. Varley, M.A., Ph.D., Hope Professor of Zoology, University of Oxford. E. O. Pearson, M.A., Director, Commonwealth Institute of Entomology, will preside. (The paper will be illustrated by lantern slides.)

THURSDAY, 16TH APRIL, at 5.15 p.m. COMMONWEALTH SECTION. HENRY MORLEY LECTURE. '*Britain and the Technical Development of Eastern Commonwealth Countries under the Colombo Plan*', by W. Railston, M.Sc., Ph.D., F.Inst.P., Scientific Adviser to the Colombo Plan Department, Commonwealth Relations Office. (Tea will be served in the Library from 4.30 p.m.)

Fellows are entitled to attend any of the Society's meetings without tickets (except where otherwise stated), and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

SYLLABUS OF CANTOR LECTURES ON 'THE CLASSICAL COUNTRY HOUSE IN EIGHTEENTH-CENTURY ENGLAND'

LECTURE I. Monday, 2nd March. *Patronage and Performance*, 1710–40: Number and distribution of houses; critical phase of 1720–24; political and stylistic incentives; architectural types.

LECTURE II. Monday, 9th March. *Progress and Decline of the Greater House:* The prototypes of 1715–25; Wanstead, Houghton and their derivatives; planning and interior design; the 'villa with wings'; obsolescence of the greater house.

LECTURE III. Monday, 16th March. *The Idea of the Villa:* The word 'villa' in eighteenth-century usage; the prototype villas and their metamorphoses; the villa of 1780–1800 as the product of social change.

FILM EVENING

The last Film Evening of the present Session will be held at the Society's House on Friday, 13th March, at 7.30 p.m. The programme will be as follows:

Beauty in Trust

Energy for Europe

A Walk in the Forest

Animal, Vegetable, Mineral

Beauty in Trust (23 minutes) is the first of a series of colour films under the general title of *Our National Heritage*, which is being sponsored by the National Benzole Company on behalf of the National Trust. It is a delightful film, featuring a number of the thousand or so properties now owned by the Trust and ranging from the wild coast of North Cornwall and the rugged grandeur of the Lake District to the stately homes of England, as represented in the film by Claydon House in Buckinghamshire. The film was made by Random Film Productions and the commentary is by John Betjeman.

Energy for Europe (24 minutes) is an Esso film and focuses attention in a simple but impressive manner on the nature and magnitude of the energy problem in Britain and in Western Europe. It illustrates the various modern methods of producing power by scenes taken in ten different countries.

A Walk in the Forest (22 minutes) is a colour film, based on fact, telling the story of a geological survey team in the Papuan jungle and of the suspicions and superstitions which it encountered there. It was produced by James Hill for the British Petroleum Company.

Animal, Vegetable, Mineral (11 minutes) is a colour cartoon made by Halas and Batchelor for the British Petroleum Company. It shows in an amusing but factual manner how lubrication has developed from the animal and vegetable fats used in olden days to the petroleum lubricant of to-day.

Tickets of admission are not required for this occasion and Fellows are entitled to introduce two guests. Light refreshments will be served in the Library after the performance.

THE ALBERT MEDAL

The Council are considering the award of the Albert Medal of the Royal Society of Arts for 1959. They therefore invite Fellows of the Society to forward to the Secretary as soon as possible the names of such men of high distinction as they think worthy of this honour. The Medal was struck to reward 'distinguished merit in promoting Arts, Manufactures and Commerce', and has been awarded in previous years as follows:

1864	Sir Rowland Hill
1865	HIS IMPERIAL MAJESTY THE EMPEROR NAPOLEON III
1866	Michael Faraday
1867	Sir W. Fothergill Cooke and Sir Charles Wheatstone
1868	Sir Joseph Whitworth
1869	Baron Justus von Liebig
1870	Vicomte Ferdinand de Lesseps
1871	Sir Henry Cole
1872	Sir Henry Bessemer
1873	Michael Eugène Chevreul
1874	Sir C. W. Siemens
1875	Michel Chevalier
1876	Sir George B. Airy
1877	Jean Baptiste Dumas
1878	Sir Wm. G. (afterwards Lord) Armstrong
1879	Sir William Thompson (afterwards Lord Kelvin)
1880	James Prescott Joule
1881	Professor August Wilhelm Hofmann
1882	Louis Pasteur
1883	Sir Joseph Dalton Hooker
1884	Captain James Buchanan Eads
1885	Sir Henry Doulton
1886	Samuel Cunliffe Lister (afterwards Lord Masham)
1887	HER MAJESTY QUEEN VICTORIA

1888	Professor Hermann Louis Helmholtz
1889	John Percy
1890	Sir William Henry Perkin
1891	Sir Frederick Abel, Bt.
1892	Thomas Alva Edison
1893	Sir John Bennet Lawes, Bt., and Sir Henry Gilbert
1894	Sir Joseph (afterwards Lord) Lister
1895	Sir Isaac Lowthian Bell, Bt.
1896	Professor David Edward Hughes
1897	George James Simons
1898	Professor Robert Wilhelm Bunsen
1899	Sir William Crookes
1900	Henry Wilde
1901	HIS MAJESTY KING EDWARD VII
1902	Professor Alexander Graham Bell
1903	Sir Charles Augustus Hartley
1904	Walter Crane
1905	Lord Rayleigh
1906	Sir Joseph Wilson Swan
1907	The Earl of Cromer
1908	Sir James Dewar
1909	Sir Andrew Noble
1910	Madame Curie
1911	The Honble. Sir Charles Algernon Parsons
1912	Lord Strathcona and Mount Royal
1913	HIS MAJESTY KING GEORGE V
1914	Senatore (afterwards Marchese) Guglielmo Marconi
1915	Sir Joseph John Thomson
1916	Professor Elias Metchnikoff
1917	Orville Wright
1918	Sir Richard Tetley Glazebrook
1919	Sir Oliver Joseph Lodge
1920	Professor Albert Abraham Michelson
1921	Sir J. Ambrose Fleming
1922	Sir Dugald Clerk
1923	Major-General Sir David Bruce and Colonel Sir Ronald Ross
1924	H.R.H. THE PRINCE OF WALES
1925	Lieut.-Colonel Sir David Prain
1926	Professor Paul Sabatier
1927	Sir Aston Webb
1928	Sir Ernest (afterwards Lord) Rutherford
1929	Sir J. Alfred Ewing
1930	Professor Henry E. Armstrong
1931	H.R.H. THE DUKE OF CONNAUGHT AND STRATHEARN
1932	Frank (afterwards Sir Frank) Brangwyn
1933	Sir William Llewellyn
1934	Sir Frederick Gowland Hopkins
1935	Sir Robert A. Hadfield, Bt.
1936	The Earl of Derby
1937	Lord (now Viscount) Nuffield
1938	HER MAJESTY QUEEN MARY
1939	Sir Thomas H. Holland
1940	John A. Milne
1941	President Franklin D. Roosevelt
1942	Field-Marshal J. C. Smuts
1943	Sir John Russell
1944	Sir Henry Tizard
1945	Winston (now Sir Winston) Churchill
1946	Sir Alexander Fleming and Sir Howard Florey
1947	Sir Robert Robinson
1948	Sir William Reid Dick
1949	Sir Giles Gilbert Scott
1950	Sir Edward Appleton
1951	HIS MAJESTY KING GEORGE VI
1952	Sir Frank Whittle
1953	Dr. E. D. (now Lord) Adrian
1954	Sir Ambrose Heal
1955	Dr. Vaughan Williams
1956	Sir Henry Dale
1957	Sir Christopher Hinton
1958	HER MAJESTY QUEEN ELIZABETH II

OFFER OF ENDOWED PRIZES, 1959

The Society, as Trustee for the undermentioned endowments, offers the following prizes during the year 1959:

HOWARD PRIZE OF £50 FOR MECHANICAL MOTIVE POWER

The Howard Trust was established in 1868 for the purpose of making awards periodically to the authors of treatises on steam or other motive agents, and

a prize of £50 is offered for award to the author of a treatise on some aspect of the subject of motive agents. Works already published are eligible for this award.

FOTHERGILL PRIZE OF £20 FOR FIRE PREVENTION OR FIRE FIGHTING

Under the Fothergill Trust (established by the will of Dr. Fothergill in 1821) a prize of £20 is offered for a descriptive essay or model embodying some new idea for the prevention or suppression of fire.

Conditions of Entry

(1) Entries for the above prizes must be received by the Secretary of the Royal Society of Arts, 6/8, John Adam Street, Adelphi, London, W.C.2, not later than 31st July, 1959, and must be clearly marked with the entrant's name and address, and the prize for which they are submitted. Essays must be typed.

(2) The Society cannot accommodate bulky apparatus for judging. Entries must be submitted in the form of written descriptions or models, but the Society may subsequently require a demonstration with the actual apparatus.

(3) The Society reserves the right to divide or withhold all or any part of the above prizes, should the quality of the entries justify such a course.

(4) The Society reserves the right to exhibit or publish any entries (the copyright being retained by the competitor).

(5) The Society cannot accept any responsibility for the safety of papers or models submitted to it for the purpose of these awards.

(6) The decision of the Council of the Society regarding all matters connected with the awards will be final, and correspondence cannot be entered into regarding the reasons for any decisions it may take.

The Council is anxious to give the widest publicity to these offers and would therefore appreciate any assistance which Fellows may be able to give in making them known. Copies of the particulars for distribution will be sent on request.

NEW HONORARY CORRESPONDING MEMBERS IN NORTH AMERICA

The Council has appointed the following to be Honorary Corresponding Members of the Society:

Canada: Montreal—A. B. Illievitz, M.D., C.M., M.Sc. (1497 Bishop St., Montreal)

Ottawa—E. P. Weeks, M.A., B.Litt., D.Phil. (Economic Study Division, Department of Public Works, Hunter Building, Ottawa)

U.S.A.: Washington, D.C.—W. A. Taylor, M.Arch., F.A.I.A. (American Institute of Architects, 1735 New York Avenue, Washington 6, D.C.)

Boston—Bradford Williams, A.B., M.L.A. (235 Westfield St., Needham, 92, Massachusetts).

THE SWINEY PRIZE CUP

Illustrated here is the Swiney Prize Cup which was presented to Dr. Keith Simpson by the Chairman of Council on 9th February. Designed by Mr. David Mellor, Des.R.C.A., the cup is raised in heavy guage silver and treated with a hammered thickened edge. The body is almost round at the base, transforming into a square with full sides and radiused corners. The top edge of the cup is mounted with a triangular section gold wire, and on the front face is mounted the emblem of the Royal Society of Arts carved in 18 ct. yellow gold.

As announced in the last issue of the *Journal*, the Swiney Prize for 1959, consisting of this cup and £100 in cash, was awarded to Dr. Simpson for his work, *Forensic Medicine* (third edition).

MEETING OF COUNCIL

A meeting of Council was held on Monday, 9th February, 1959. Present: Sir Alfred Bossom (in the Chair); Mrs. Mary Adams; Dr. W. Greenhouse Allt; Sir Edward Crowe; The Honble. G. C. H. Chubb; Mr. R. E. Dangerfield; Sir George Edwards; Mr. Peter Le Neve Foster; Mr. John Gloag; Dr. R. W. Holland; Mr. William Johnstone; Lord Latham; Sir Harry Lindsay; Mr. F. A. Mercer; Mr. Oswald P. Milne; Lord Nathan; the Earl of Radnor; Sir Gilbert Rennie; Sir Selwyn Selwyn-Clarke; Professor S. Tolansky; Mr. G. E. Tonge; Sir Griffith Williams and Miss Anna Zinkeisen; with Dr. K. W. Luckhurst (Secretary), Mr. G. E. Mercer (Deputy Secretary) and Mr. J. S. Skidmore (Assistant Secretary).

ELECTIONS

The following candidates were duly elected Fellows of the Society:

Batt, Miss Barbara Gordon, N.D.D., Gloucester.
Bennet-Clark, Professor Thomas Archibald, M.A., Ph.D., F.R.S., Colchester, Essex.
Brangwyn, Leslie Maurice Leopold, London.
Brocklehurst, John Anthony, Wirral, Cheshire.
Cockle, Mrs. Frances Aileen, Aughton, Lancs.

Couch, Harold Kennan, B.S., M.A.S.M.E., Charlotte, North Carolina, U.S.A.
Farrimond, George Joseph, Newcastle-on-Tyne.
Ford, Mrs. Ruth Van Sickle, Chicago, Illinois, U.S.A.
Fuggle, Bernard Wallace Inskip, Helston, Cornwall.
Fuggle, Wallace Arthur Stanley, Helston, Cornwall.
Gibberd, Frederick, C.B.E., F.R.I.B.A., M.T.P.I., London.
Hammond, Peter, N.D.D., Luton, Beds.
Hawkins, Herbert Reginald, Woodford Green, Essex.
Hinton, Sir Christopher, K.B.E., F.R.S., London.
Holmes, Henry Cuthbert, M.A., J.P., Victoria, British Columbia, Canada.
Hubble, Harry Denniss, Maidstone.
Joyce, Donovan George, A.R.I.B.A., Tunbridge Wells.
Kirkland, George William, M.B.E., M.I.C.E., London.
Lionheart-Richardson, Victor Walter Raymond Charles, B.A., London.
Lunn, Edward, Northampton.
Lewis, John Noel Claude, F.S.I.A., Woodbridge, Suffolk.
MacKenzie, William, A.T.D., Halifax.
Mann, Bruce Douglas, A.R.P.S., Port Elizabeth, South Africa.
Moore, Patrick, F.R.A.S., East Grinstead, Sussex.
Prentice, Wilbur Miller, Toronto, Ontario, Canada.
Parkin, Iain Robert, M.A., Watford, Herts.
Roberts, Lewis Cecil, F.R.I.C.S., London.
Rogers-Coltman, Mrs. Olive Teresa Margaret, Bishops Castle, Shropshire.
Ross, The Honble. Frank MacKenzie, C.M.G., K.St.J., LL.D., Vancouver, British Columbia, Canada.
Sadler, Kenneth George, N.D.D., Birmingham.
Sherman, Winnie Borne, B.F.A., New York City, New York, U.S.A.
Short, Hugh Oswald, Hon.F.R.Ae.S., Lynchmere, Surrey.
Stuart, Ian, Thames Ditton, Surrey.
Swinburn, Mrs. Elsie, Tiverton, Devon.
Taylor, Sir John, K.B.E., C.M.G., London.
Trench, Peter, O.B.E., T.D., B.Sc., London.
Tucker, Charles Edward, Plympton, Devon.
Wayne, Philip Arthur, M.A., London.

The following was admitted as an Institution in Union:

Alderman Library, University of Virginia, Charlottesville, Virginia, U.S.A.

PRESENTATION OF SWINEY PRIZE

Dr. Keith Simpson was introduced before the Council and received from the Chairman the Swiney Prize for 1959.

HONORARY CORRESPONDING MEMBERS IN NORTH AMERICA

Approval was given to the appointment of two new Honorary Corresponding Members of the Society in Canada, and two in the United States (see separate notice on p. 229).

VACANCY ON COUNCIL

Mr. Paul Reilly was elected to fill the vacancy on the Council created by the resignation of Mr. Robin Darwin.

INDUSTRIAL ART BURSARIES COMPETITION

The recommendations made by the Industrial Art Bursaries Board in respect of the Competition held in 1958 and the arrangements for a Competition in 1959 were adopted (see separate report on page 232).

OTHER BUSINESS

A quantity of financial and other business was transacted.

INDUSTRIAL ART BURSARIES

1958 COMPETITION

At the request of the Council, the Industrial Art Bursaries Board again organized a competition in 1958. Bursaries, in most cases of £150 each, were offered in 16 different sections. These covered the following subjects: acrylic sheet ('Perspex'); carpets; clocks and watches; domestic electrical appliances; domestic solid-fuel-burning appliances; dress textiles; electric-light fittings; footwear; furnishing textiles; furniture; laminated plastics; packaging; stage and television settings; typography; wall-paper; and women's fashion wear (in this section two awards, of £200 and £100 respectively, were offered under the Bianca Mosca Memorial Trust). The Sir Frank Warner Memorial Medal was also offered for the best design in the carpet, dress textiles, and furnishing textiles sections.

The competition was open* to full-time or part-time students, between the ages of 17 and 30, of art, architectural, technical or other colleges or schools approved by the Society. In certain sections eligibility was extended to include young draughtsmen, clerks or other similar persons engaged ini ndustry, whether or not they had had any previous art school training, provided that they were recommended as having sufficient ability to compete in a national competition by a responsible officer of the industry concerned. In all, 495 candidates from eighty schools and industrial establishments entered the competition; this compares with 423 candidates in 1957, 412 in 1956, and 330 in 1955, in which years the numbers of schools and industrial establishments represented were 70, 70, and 66 respectively.

Candidates were required both to undergo a set test, carried out under invigilation, and to submit examples of work, chosen from the work done by them in the ordinary course of their studies.

As in the past, the Council's purpose in arranging the competition was to enable successful candidates to enlarge their knowledge and experience by travel abroad and the study of foreign design, or in certain cases to obtain art training or industrial experience in this country. The success of the tours made by Bursary winners depends largely upon their meeting manufacturers and industrial designers in the countries visited, and in past years many people in this country have kindly given assistance by providing helpful introductions. In this connection the Bursaries Board would be grateful to hear from Fellows who may be able to help these students when the latter are abroad.

The Council desires to express its thanks to all those who have assisted and advised in the conduct of the competitions: particularly to the firms, organizations and individuals who generously subscribed towards the cost of the Bursaries, to the Juries for their voluntary services, and to the heads of those organizations entering candidates for their co-operation.

* Special conditions applied to the women's fashion section.

The Council, adopting the recommendations of the Industrial Art Bursaries Board based on the reports of the Juries, has awarded 25 Bursaries, amounting in value to £3,300. The following awards and commendations have been made in connection with the 16 sections included in the competition:

DOMESTIC ELECTRICAL APPLIANCES

Bursary (£150): *Mr. L. Wolf** (Newcastle-upon-Tyne College of Art and Industrial Design: age 19)

Commended: Mr. A. Mantle (National Plastics Group of Companies: age 21) and *Mr. J. F. Wickham* (L.C.C. Central School of Arts and Crafts: age 24)

ELECTRIC LIGHT FITTINGS

Bursary (£150): *Mr. R. M. Whitehead* (Newcastle-upon-Tyne College of Art and Industrial Design: age 21)

DOMESTIC SOLID-FUEL-BURNING APPLIANCES

Bursary (£150): *Mr. D. L. Wheeler* (L.C.C. Central School of Arts and Crafts: age 21)

CARPETS

Bursary (£150): *Mr. P. J. Allen* (Kingston-upon-Thames School of Art: age 20)

Commended: Miss N. Behr (Royal College of Art: age 19) and *Miss S. C. Williams* (Stockport School of Art: age 17)

DRESS TEXTILES

*Bursaries: Miss K. Garwood** (West Sussex College of Art and Crafts: age 19) and *Mr. A. N. Payne** (South-West Essex Technical College and School of Art: age 17) £150 *each*

Commended: Miss P. A. Croot (Hornsey College of Art: age 20), *Miss J. Hardman* (Leeds College of Art: age 20) and *Miss F. M. Hillier* (Royal College of Art: age 22)

FURNISHING TEXTILES

*Bursaries: Miss G. A. Carmichael** (Liverpool College of Art: age 20) £150 and *Mr. R. W. Heap* (Manchester Regional College of Art, and R.A.O.C. Tripoli: age 21) £75†

Commended: Mr. H. Henderson (Gray's School of Art, Aberdeen: age 22) and *Mr. I. Munro* (Gray's School of Art, Aberdeen: age 23)

WOMEN'S FASHION WEAR

*Bianca Mosca Awards: Miss J. M. Checkley** (Royal College of Art: age 20), *Miss R. A. Grima* (Royal College of Art: age 24) and *Miss J. D. Morris** (Royal College of Art: age 19) £100 *each*

Commended: Miss M. R. Boulton (L.C.C. Hammersmith School of Building and Arts and Crafts: age 18), *Miss M. M. Harrison* (Brighton College of Art: age 23) and *Mr. P. W. Sumner* (Royal College of Art: age 23)

* Also awarded Associate Membership of the Society.
† Supplementary Bursary from the Art Congress Studentship Trust Fund.

ACRYLIC SHEET ('PERSPEX')

Commended: Mr. K. S. Batty (L.C.C. Central School of Arts and Crafts: age 23) and *Mr. T. F. Sullings* (Twickenham Technical College: age 17)

LAMINATED PLASTICS

Bursary (£150): *Miss S. C. Williams** (Stockport School of Art: age 17)

Commended: Miss A. E. Banks (City of Carlisle College of Art: age 18) *Mr. W. D. James* (Royal College of Art: age 20) and *Miss G. J. Wallace* (City of Carlisle College of Art: age 18)

CLOCKS AND WATCHES

Bursary (£150): *Mr. W. Blakey* (Leicester College of Art: age 21)

Commended: Miss S. M. White (L.C.C. Central School of Arts and Crafts: age 19)

STAGE AND TELEVISION SETTINGS

Bursaries: Mr. W. B. Holdaway (Royal College of Art: age 24) and *Mr. J. R. Stokes** (Wimbledon School of Art: age 18) £150 *each*, and *Miss A. C. Curtis* (L.C.C. Central School of Arts and Crafts: age 21) £75†

Commended: Mr. B. R. Graves (Wimbledon School of Art: age 19); *Mr. C. Howard* (Royal College of Art: age 24) and *Mr. F. D. Taggart* (L.C.C. Central School of Arts and Crafts: age 21)

FOOTWEAR

Bursary (£150): *Mr. G. N. Carr* (Northampton School of Art: age 27)

Commended: Miss J. Gifford (Leicester College of Art: age 18) and *Miss M. E. Rycroft* (Leicester College of Art: age 22)

FURNITURE

Bursaries: Mr. F. J. B. Rowley (Newcastle-upon-Tyne College of Art and Industrial Design: age 25) and *Mr. K. M. Wilkins** (High Wycombe College of Further Education: age 20) £150 *each*. *Mr. G. K. Probst** (Kingston-upon-Thames School of Art: age 18) and *Mr. T. P. Widdowson** (High Wycombe College of Further Education: age 20) £75 *each*.

Commended: Mr. T. Gilbert (High Wycombe College of Further Education: age 19), *Mr. W. H. Gray* (Newcastle-upon-Tyne College of Art and Industrial Design: age 18), *Mr. A. H. Hall* (High Wycombe College of Further Education: age 29), *Mrs. G. M. Leys* (High Wycombe College of Further Education: age 22), *Mr. A. C. Revell* (High Wycombe College of Further Education: age 19) and *Mr. D. Vizor* (High Wycombe College of Further Education: age 19)

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* Also awarded Associate Membership of the Society.
† Supplementary Bursary from the Art Congress Studentship Trust Fund.

TYPOGRAPHY

Bursary (£150): *Mr. R. H. Broughton** (Leicester College of Art: age 20)

Commended: Mr. J. H. Burniston (Leicester College of Art: age 22), *Miss J. Newing* (L.C.C. Central School of Arts and Crafts: age 19), *Mr. P. G. Rea* (Wimbledon School of Art: age 19), *Miss G. Riley* (City and Guilds of London Art School: age 24), *Mr. I. M. Scott* (Maidstone College of Art: age 19) and *Mr. P. R. Sheen* (Leicester College of Art: age 20)

PACKAGING

Bursary (£150): *Mr. M. P. McGann** (Twickenham Technical College: age 18)

Commended: Mr. S. Bernstein (Salford Royal Technical College School of Art: age 21)

WALL-PAPER

Bursary (£150): *Mr. P. W. Haines* (Ealing Technical College and School of Art: age 22)

Commended: Mr. J. A. Morgan (Royal College of Art: age 22) and *Miss M. P. Shore* (Birmingham College of Art and Crafts: age 19)

The George M. Whiley Bursary (£150): *Mr. J. F. Wickham* (L.C.C. Central School of Arts and Crafts: age 24)

Publication of Report

Full details of the 1958 competition will be contained in the annual report published in the early part of March. This report will include particulars of the tests set in each section, the names of the winning and commended candidates, the reports and composition of the Juries, and a summary of the uses made of Bursaries in 1958 by previous Bursary winners. Illustrations of many of the winning designs, a number of which are reproduced on the following pages, will also be included. Copies of the report can be obtained on application to the Bursaries Officer.

Exhibition

An exhibition of the winning and commended designs submitted in the competition will be held at the Royal Society of Arts during the three weeks preceding Whitsun. Further details will be announced in the *Journal* in due course.

1959 COMPETITION

The Council has decided to hold a further competition in :959, which will be organized on the same lines as that in 1958. Particulars of this competition will be published in June, and the list of sections to be included will be announced in the July issue of the *Journal*.

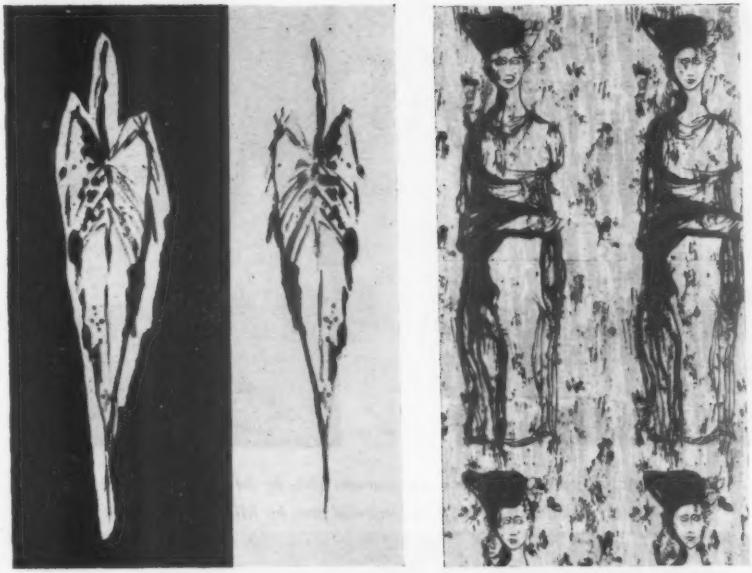
* Also awarded Associate Membership of the Society.

SOME OF THE DESIGNS

All the designs reproduced in these pages were submitted for the Set Tests: the captions are taken from the students' own descriptions

Left: *lay-out for a letter heading.* Right: *examples of original lettering. Both by Mr. R. Broughton*

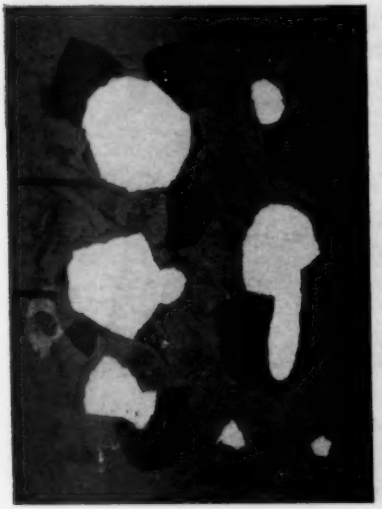
Wall-paper for a large room used for formal occasions, by Mr. P. Haines



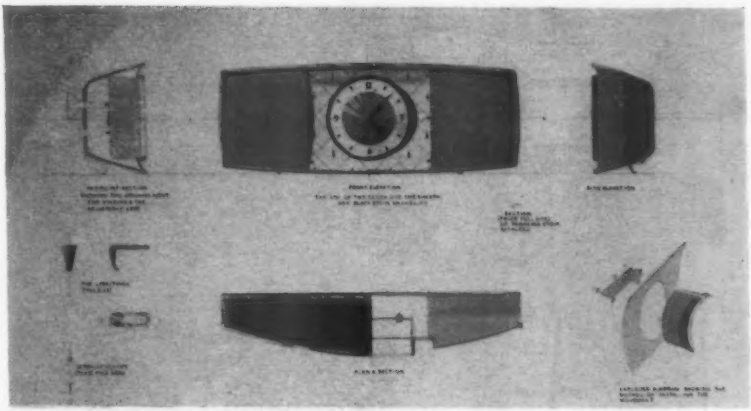
Left: *a furnishing fabric for a newly erected block of service flats, by Miss G. Carmichael.* Right: *a four-colour laminated plastics panel for use in a modern hotel, by Miss C. Williams*

A carton for a range of guest towels, by Mr. M. McGann

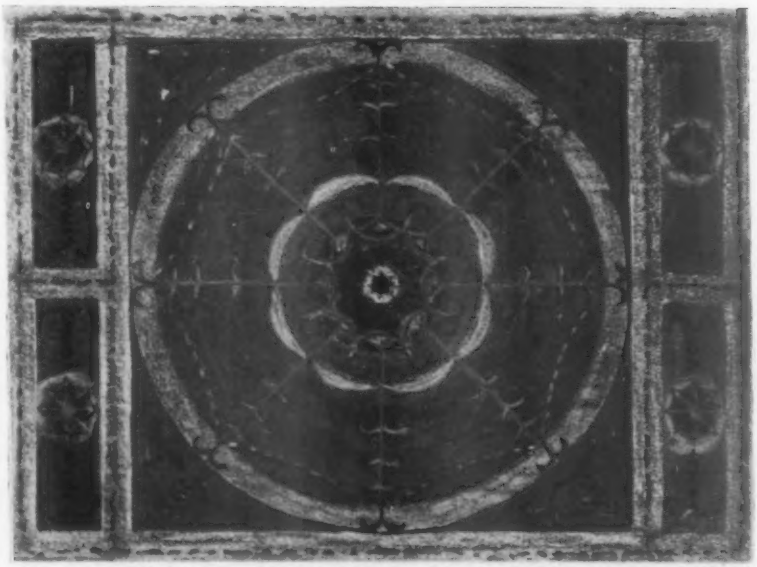
Left: *a party dress for a 16-year-old girl, by Miss R. Grima.*
Right: *a dance dress for a 16-year-old girl, by Miss J. Checkley*



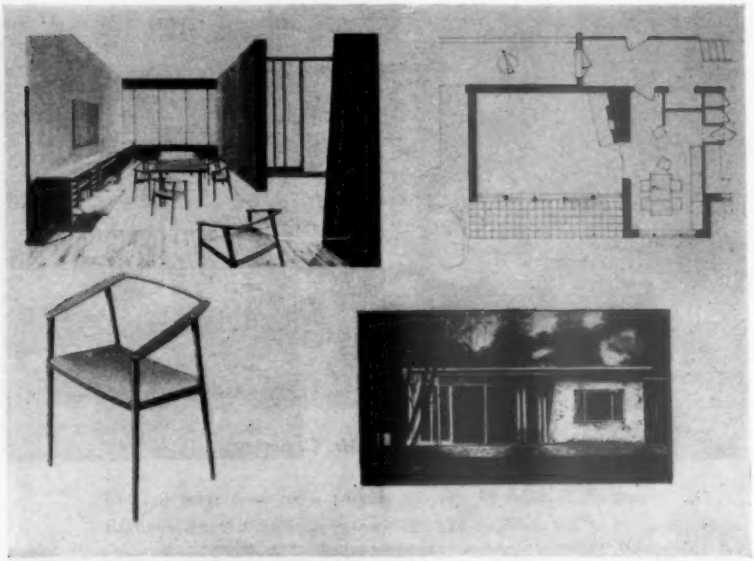
Left: *a printed dress fabric, by Mr. A. Payne.* Right: *costume for Gilles de Rais (in Shaw's* St. Joan), *by Mr. J. R. Stokes*



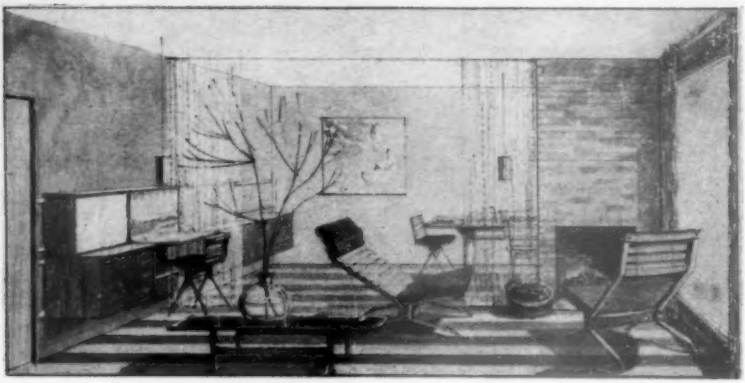
A lounge clock, by Mr. C. Blakey

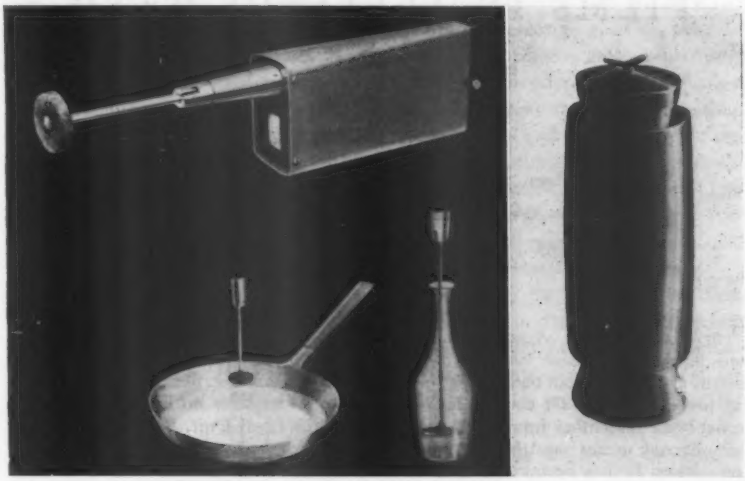


Carpet for use in a private house of Georgian character, by Mr. P. Allen

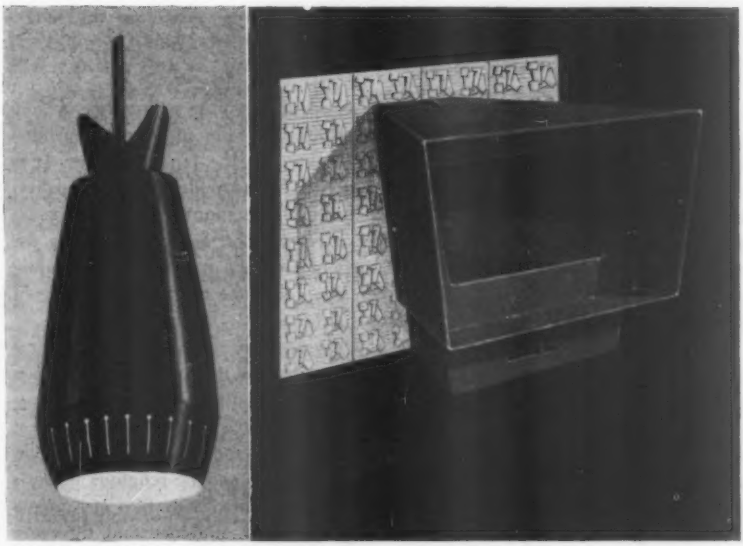


Perspective drawings of furniture for a modern bungalow, above, *by Mr. F. Rowley;* below, *by Mr. K. M. Wilkins*





Left: *an electric pot-scourer, by Mr. J. Wickham.*
Right: *an electric convector heater, by Mr. L. Wolf*



Left: *a tungsten pendant lighting fitting for use in a departmental store, by Mr. R. M. Whitehead.* Right: *a free-standing solid-fuel convector fire, by Mr. D. L. Wheeler*

FILMS IN ALLIANCE WITH INDUSTRY

A paper by

EDGAR ANSTEY,

Films Officer, British Transport Commission, read to the Society on Wednesday, 14th January, 1959, with George Pollock, Q.C., Director, British Employers' Confederation, in the Chair

THE CHAIRMAN: Mr. Anstey is one of the comparatively few people who combine considerable knowledge of films with considerable knowledge of industry, and thereby I suppose it can be said that he in his own individual experience puts practice and precept in one. Of course, as a film maker he requires no introduction. You probably all remember how, after he started off the Shell Unit, he later made two films, *Enough to Eat?* and *Housing Problems*; and since he has been at the Transport Commission he has been responsible for some very notable films, one of which has won an award of great distinction. I always remember with pleasure a film which depicted the rapidity, excellence and comforts of railway travel by depicting molluscs on the sea shore! Perhaps in the future Mr. Anstey will be able to give us a 'still' of passengers on the Underground.

The following paper, which was illustrated with excerpts from films, was then read.

THE PAPER

Most industrial film-makers have been asked at one time or another if they would not prefer to make 'real' films—by which is meant, of course, the films you pay to see at the local cinema and read about in the fan magazines. It is a sobering thought that for very many people 'real' films are films about unreality. But if films that are truly about reality, including films about industry, do seem remote and odd to audiences, then this may well be a serious matter for industrialists as well as for film-makers. It may mean that a great part of the public is not accustomed to seeing on the screen any reference to the true nature of industry. Indeed, I believe this is the fact that faces us.

I am not criticizing entertainment and saying that instead we must have education. Entertainment—having to do, as I understand it, with contact between those who give mental or emotional stimulus and those who receive it—is inseparable from all successful communication. Indeed, if we go to the highest didactic level of all, surely religious teaching itself is an entertaining method of conveying philosophical truths and moral precepts, and no religious leader's work has survived if he was not also a great entertainer? Our film statements about reality must be entertaining or they lose their audience and therefore their purpose.

Neither am I arguing that truth about society cannot be conveyed in the

local Odeon. Griffiths, Eisenstein, Ford, even Bing Crosby and Danny Kaye, all have been known to preach successfully from the screen in good causes.

I am asking you this afternoon to do no more than remove from your minds the often meaningless distinctions between the two broad purposes of films—entertainment and education—and to join me in examining some of the functions of films as a means of communication between man and men, whatever the motive. I hope to persuade you that the organizational patterns and the psychological motivations of industry are subjects on which we need more films.

There was in 1957 a useful occasion (shortly to be repeated) which provided us with a good list of possible film purposes in regard to contemporary industrial society. I refer to the Harrogate Festival of Films in the Service of Industry.

Under the patronage of H.R.H. the Prince Philip, the Presidency of Lord Godber and the Chairmanship of Mr. Frank Hoare, the Festival invited British industrial sponsors to submit films in the following categories: 'Public Relations and Prestige', 'Sales Promotion', 'Training Inside Industry', 'Technical and Technological Films', 'Films for use in Schools', 'Sales and Dealer Training', 'Health and Safety in Industry', 'Guidance on Careers in Industry', 'Industrial Productivity', and 'Human Relations in Industry'. The council of the Festival consisted of representatives of the widest possible range of British national bodies having any connection with industrial life and ranging from the Trades Union Congress to the British Employers Confederation (whose director has been good enough to take the Chair here to-day) and from the Royal Society for the Prevention of Accidents to H.M. Board of Trade. The selection panels viewed 320 films to make awards; and it is worth noting that the juries found themselves unable to select a runner-up to the prize-winner in three categories—'Technical and Technological Films', 'Guidance on Careers in Industry', and 'Films for use in Schools'. Partly this was due to sparse entries, but this in itself further emphasized that the bulk of the effective effort of industrial films sponsors appears to be directed towards Public Relations, Prestige and Sales Promotion. The nature of the Prestige which is generally sought we shall consider later.

When the Festival is repeated in April of this year emphasis will be thrown (at the suggestion of the Board of Trade and the Central Office of Information) on the use of films to encourage exports. In addition, there will be two new awards given by the British Association for the Advancement of Science for films which illuminate the relationship between science and industry. Sir John Cockcroft will read a paper on this same subject.

It will be interesting in April to see whether the categories concerned with the pursuit of industrial well-being have been as well supported as the categories concerned with the pursuit of industrial prosperity. It is, of course, true that industry must be judged by its results, but since industry is not only a means to production but also a way of life, the results by which it is judged include the state of mind it engenders both inside and outside itself.

It was Mr. Stuart Legg who once gave to a film in the Canadian 'World In Action' series a title which has always seemed to me the most significant of all

A camera crew poised above a model of the British Isles

documentary titles—*The War for Men's Minds*. This was a film about society rather than industry, but whether or not we are concerned with sociology this afternoon we are certainly concerned with the war for men's minds.

Let me show you an excerpt from a film which seems to me to have great bearing on our subject this afternoon. It is a film called *Family Portrait*, and was made for the Festival of Britain by the late Humphrey Jennings. It is also the best sales film for British industry as a whole that I know.

Some of you may have come here this afternoon prepared for yet another extolling of the virtues of the British documentary school of film-makers. And I shall not altogether disappoint you. It would be impossible to make no reference to the pioneering work of Mr. John Grierson and the late Sir Stephen Tallents who, had he been spared to us, would have sat in the Chair now occupied by Mr. Pollock (and how pleased Sir Stephen would be to see the Director of the British Employers' Confederation sitting there in his stead). In much that I shall say there will be implicit or direct reference also to the work of Mr. Basil Wright, Sir Arthur Elton, Mr. Paul Rotha, Mr. Stuart Legg, Mr. Harry Watt, and those other of my colleagues and friends in documentary film-making who have explored the world of industry with cameras and microphones.

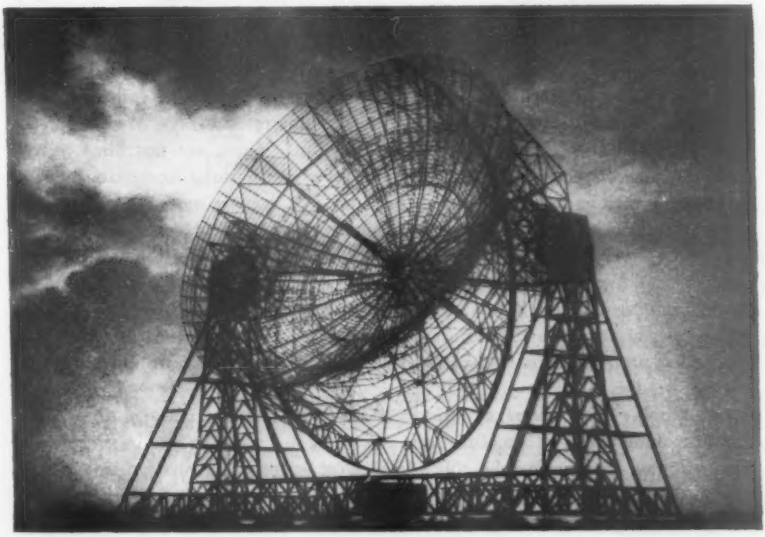
I am asking you now to look not at a production of one of those I have named but at the work of a director and a much loved colleague who, though from the

same film-making school, brought a quality of difference to his films which is highly relevant to this afternoon's paper. Jennings was an artist in paint as well as celluloid; he was interested in surrealism and in the nineteenth-century pioneers of British mechanical and civil engineering. He brought therefore a rather special imagination to bear on the problems of British industry to-day.

Under the influence of Tom Harrisson and Charles Madge's 'Mass Observation' movement of twenty years ago, he found images of industry which still haunt us with a kind of cryptic challenge—such images as the forlorn works band in his film *Spare Time*, photographed in the misty damp of a Lancashire mill town—the men, women and children in their white near-Hussar uniforms making pallid formations in the gloom as they played a whining instrument called the Kazoo; and played it with a kind of indestructible determination.

Such unforgettable images seem to me to strike near the root of what the film can still do for industry beyond the present film-making achievement, considerable though that has been.

But let us look now at *Family Portrait* with its hint at the second phase of the Industrial Revolution which as Sir Charles Snow has said, 'with its vast social and technological changes will change life more than the first'. In calling for more films about our industrial civilization Sir Charles has pointed out 'that we cannot work this kind of society unless we understand it'.



The industrial film can widen our horizons to embrace the spaces of the universe itself. (*Still of Jodrell Bank Telescope from* Mirror in the Sky: *Mullard Ltd. and the Educational Foundation for Visual Aids*)

It seems to me that Jennings' idea of the British as a people of prose and poetry, of science and craftsmanship, and Jennings' use of his art to demonstrate it (and surely this film by itself makes clear—if it were necessary to do so—that art is involved in this whole matter)—these things suggest that the industrial film can also provide us with individual or group portraits of the nation. It can 'sell' industry individually and collectively, not simply its products, but industry itself.

In the early days of documentary film-making this was well understood. John Grierson bought to England in the early '30s the first documentary film-maker, the Irish-American Robert Flaherty, to bring alive on the screen the British industrial craftsmen as men of achievement and dignity. I am going to show you the potter's and glassmaker's sequences from the film that resulted—*Industrial Britain*. For many of you it will be a reminder only—but I am sure a welcome one. Flaherty celebrated human skills by his intuitive yet precise choice of images—the exact piece of action, the exact camera position, angle and movement—particularly camera movement. He identified completely with the work being done, anticipating with his camera the changing demands of the material or the machine upon the eye and hand of the craftsman. Then he assembled the images into a rhythm which made its own contribution to our deep understanding of the process and the relation of the craftsman to it. No other single film had as much effect on those of us privileged to work with Flaherty as had *Industrial Britain*, and Arthur Elton's subsequent direction of *Aero-Engine* and Basil Wright's of *Song of Ceylon* showed that they had understood that in the hands of an artist the camera can be as sensitive and flexible as a brush. Few contemporary films show the same mastery of camera movement, and I believe we have lost ground in the portrayal of a man's pride in his industrial skill.

Many industrial films of to-day are merely illustrated essays. Words are the senior partner, the pictures lag faithfully behind. These are not films in any sense that need concern us this afternoon. They add nothing to existing literary concepts, let alone to creative film-making. For we are not concerned with lantern lectures. Rather are we concerned with the direct communication of experience by picture and sound to the point of an illusion of physical participation. We experience the images of a good film to a point of seeming to touch, seeming to feel the physical environment. But not simply for physical reasons. In my opinion the ultimate object is the communication of emotional experience, and emotional experience that can beget the desire to build on one's new knowledge.

This sharing of emotional experience may come in an instructional film on the handling of metal just as forcefully as it may come in a more ambitious production designed, say, to examine the rôle of the steel industry in relation to national prosperity. It is a matter of images and not of propaganda intention. The sense of mystery may be implicit in the simplest scene; it is a matter of the artist and his vision.

Perhaps you may ask me what is the significance *to industry* of this mystery, this artist's vision.

Even in an age of automation and atomic energy the individual skill of the craftsman must be handed on. (*Still from* Work in Progress: *British Transport Commission*)

The question is best answered I think by looking back into one's childhood. For many of us it was true that the steelworks, the ship-building yard, the foundry, the coalmine—particularly the coalmine—represented the outward shape of a world of inconceivable excitement, and indeed glamour; and I find this as true of my own young son as it was true of my generation.

How sadly one contrasts the adult conception of industry with the dreams of the schoolboy. For too many of us as we grow older industry becomes a spiritual wilderness from which we flee—counting ourselves lucky to do so—to some week-end rural retreat. Industry is something which we work to escape from. And yet the industrial world is much closer to the truth of our contemporary life than is the rural retreat. Industry represents the choice that our civilization has made, we cannot reject it as individuals without exposing ourselves and our generation to a dangerous schizophrenia. Whether we like it or not, machines have become the major factor in our human environment, machines and not farms and fields. It is from industry that are coming the machines with which we shall ultimately move out into the universe. It is from industry that are

coming new possibilities of health and happiness for the generations to come. The nuclear bomb is only one product of industry. May we not best avoid it by taking our heads out of the sand and celebrating some of industry's other achievements? Yet how much artistic attention is devoted to-day to what is often and oddly called the unspoiled countryside (oddly so called because it is not exactly a teeming jungle which has not known the hand of man). By contrast, how little artistic attention is given to those great industrial creations of man which do most to distinguish him from the other animals.

How can we expect to attract the pick of the nation's young men and women to industry unless they know something more about it than the label on a packet? Our prestige films for industry must be more profound about what is happening in the minds of our great men of science and industry, and less obsessed by what is displayed on the shopkeeper's counter.

The conclusion I reach is that industry needs the goodwill the artist can bring it. And because of the special power of the film medium to probe, to select and then to create a new revelation, I believe that the film artist has a special part to play.

He has a special part to play in finding some new driving force which will appeal to the whole man engaged in industry, to his mind, his heart and his spirit, not simply to his pocket.

Railway signalmen to-day can use electricity to control thirty miles of track from one box. (*Still from* This is York: *British Transport Commission*)

In the British Transport Commission we are using films to arouse interest in the ideals of public service not only amongst our staff but amongst their families also. The importance of work such as this seems to me to go far beyond the nationalized industries. No one to my knowledge has been able to improve on the sense of public service as a motive for industrial effort which will satisfy the moral appetite existing in every industrial field.

But the rôle of the film artist is certainly not restricted to those industrial films that set out to deal with matters of great moment on a high moral plane. For example, he may play his part in the industrial training film. Let us not forget that the film that shows a trainee how to do a job has only achieved half its task if it does not also create in him a pleasurable anticipation of doing his job well. The film artist has his part to play too in the film which embodies the results of the research worker. It is here that all the extraordinary powers of the medium become most obvious: cinemicrography, slow motion, speeded-up motion, animated diagrams and the rest. And to arrive at the philosophical pattern lying behind the physical facts, here again the artist's vision becomes essential.

Clearly, too, in films dealing with human relations in industry the artist is needed if we are to find our way to the motivations of human behaviour and interpret them for our audiences. I think it was Lord Chandos who pointed out that in an age of atomic energy and automation, internal relations in industry become more and not less important. Particularly in this field the power of the film to re-create experience and to communicate it could be of enormous value.

Industry is giving much attention these days to increasing productivity, and it is good to see that the British Productivity Council not only is making films, but is showing that such films must be as much about people as about machines and that films about people call for an artist's vision.

I want to show you an excerpt from the British Productivity Council's film called *Men at Work*, directed by John Waterhouse and produced by James Carr.

If any of you felt that I was calling for the artist to produce a glamourized picture of industry, I hope that this excerpt will have corrected the impression. What we want is not glamour but truth—something much more difficult and indeed much rarer. This means that we shall have controversy. Our films will sometimes deal with strikes and such emotive symbols as shop stewards. From North American producers and particularly from the National Film Board of Canada have lately come several outspoken films on subjects of this kind.

In our films we cannot afford to do without controversy. What a poor blinkered outlook if we were offered only one social philosophy for industry! The film-maker has the opportunity to describe the challenging alternatives and it is for the audience, inside industry as well as outside, to choose the path. At the present time the man and woman in the street and the factory have to make a choice from woefully few facts.

The gas industry, the oil industry, the chemical industry, the steel industry, the coal industry and the transport industry, amongst others, have a fine record

The film-maker looks for industrial motivations in the home as well as in the factory. (*Still from* Men at Work: *British Productivity Council*)

of sponsorship of films of process, of films designed to sell their wares, and in general public service by film. The international reputation of Britain in the industrial film field could not have been achieved without the imagination and drive of public relations figures such as Mr. Jack Beddington, at Shell-Mex and B.P. and later in the Ministry of Information, who sponsored Mr. Paul Rotha's *Contact*, one of the first industrial documentaries, in the very early thirties. Then there were Messrs. Ryan, Leslie and Lucas at Gas, Wolcough at Shell, Tritton at British Petroleum, and Jack Brebner, who has been the guide, philosopher, friend and, indeed, the guardian angel of our British Transport Films Service. To-day's needs make new demands on film makers. In particular we must examine the structure of our great industries in relation to the factors without which they become meaningless. Every industry is man-made, its survival depends upon those men and women who work in it, those men and women whom it serves, and those men and women in the other industries with which it has a vital relationship. There are, of course, also plants and machines, but these are the creations and still the servants of men and women. The citizen of to-day often feels himself forced to adjust to an unnatural way of life imposed by industrial civilization. The failure to understand and to come to terms with

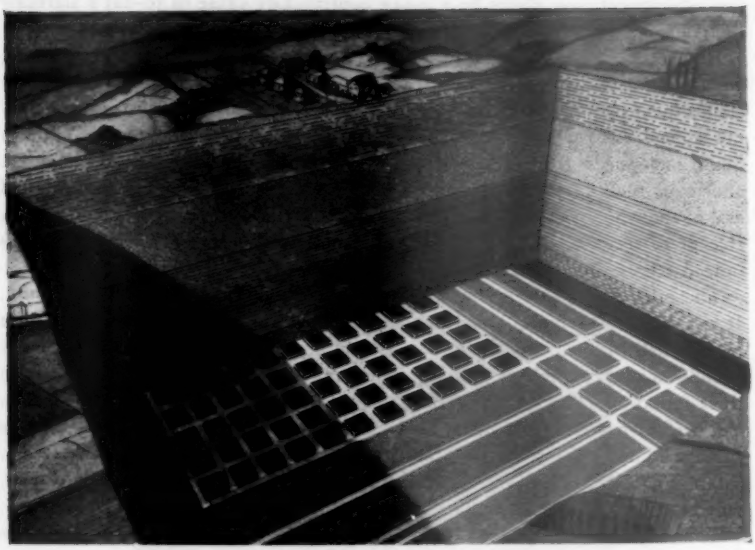
this adjustment may surely be a major contributory cause of to-day's alarming figures for mental illness.

How often in our industrial films, technically impeccable as they may be, we are dazzled by the gyrations of shining metal shapes in whose vast shadow stands the insignificant worker, scarcely a creature of flesh and blood and certainly not a man endowed with a home, a family and private aspirations. Yet this figure introduced into the corner of the frame to display to best advantage the enormous scale of the colossus he serves is, oddly enough, the beginning and end of the whole business. He is the master and not the servant of the machine. Except to serve his needs and to implement his dreams the shining metal is indeed a grotesque nightmare.

The other day I saw a film on B.B.C. Television called *Joe the Chainsmith*. It was directed by Philip Donnellan. For me it brought alive a whole way of life in a British Midlands town. We saw an industry but also we saw people in the round—at play, as well as at work—in their homes and their pubs as well as in their foundries. The spirit of Humphrey Jennings was certainly abroad again. Yet we film-makers are doing nothing regularly in films comparable to the service performed weekly for British agriculture by 'The Archers' on B.B.C. Radio. 'Starr and Company' on Television, intended no doubt as an industrial equivalent, failed to achieve either the authority or the wide public response of 'The Archers'.

You may ask me about the distribution of films made for industry. How can I guarantee that industrially-sponsored films will be seen by an audience large enough to justify the relatively high cost of such a method of public information? Certainly it would be foolhardy to rely either on television or on the public cinemas, although both channels are available and many sponsors have been able to make advantage of them. The soundest answer to the question of distribution is the non-theatrical showing of films to industrial and professional groups, to societies, clubs and educational institutions of all kinds. Such distribution can be developed to give a cost per head figure comparable with what is possible in any other medium of mass communication. In the Transport Commission we reach our non-theatrical audience—which we count in millions—at a fraction of a penny per head, this covering both production and distribution cost and taking no account of the prior revenue from theatrical distribution arising in the case of many of our productions.

For the cinemas can be used, as the Transport Commission and the National Coal Board particularly have found. Television can be used, as the Oil Industry particularly has found. Indeed, if it were not for the occasional intrusion of the industrial sponsor on our cinema screens I sometimes feel that we might come to believe that our life to-day is lived entirely in drawing-rooms or the pages of history. In my opinion we miss to-day those outstanding examples of monthly screen journalism, *The March of Time* and *This Modern Age*, with both of which I had the honour to have some small association. Our television producers, although clearly aware of the informational gap to be filled, often seem to snap rather petulantly at the heels of contemporary history without persuading it to reveal itself. Yet at any rate they try! It was Mr. Geoffrey Bell in the British Film



A film diagram reveals room and pillar workings in a mine beneath an area where there are buildings and subsidence must be prevented. (*Still from* Winning the Coal: *National Coal Board*)

Academy Journal who once analysed over one hundred films listed in a cinema-goer's guide as currently in distribution and discovered that for ninety-six of them 'the existence of industrial activity in our civilization was about as prominent as in pre-dynastic Egypt'. With what pleasure and surprise do the rare exceptions, films like *Chance of a Lifetime*, *Executive Suite*, *The Man in the White Suit*, and *Patterns of Power* confront us with the industrial skeleton in our escapists' cupboard!

Before returning to end my paper with some conclusions on the industrially-sponsored film, I should like to say here that the main reason I have chosen for my title 'Films in Alliance with Industry', is because there does exist the possibility of a true partnership. If film-makers providing entertainment for the public cinemas and for television could become seized with some part of the drama and poetry of our industrial civilization they might reveal to their public the wonderful world which we now blindly inhabit. The benefit to industry of such a revelation would certainly be no less than to the world of entertainment.

Such a development in the world of entertainment can be encouraged by industry: it should not be controlled by it. With industry's own financial resources —and I would include the trade unions here—we must continue to sponsor films in all the categories mentioned earlier and we must enlist more often the vision of the artist to seek out the telling and memorable image, whether our

film is teaching a clerk how to file his papers, persuading an overseas buyer that our locomotives are still the best in the world or encouraging parties of school children to go nature-studying by train. More often than we do now we must persuade our audiences of the quality of our industries as well as the quality of their branded products, and in this sense sell our industries to the workers who run them as well as to the public they serve. Indeed, we might go further and abolish this often spurious distinction between the public as producer and the public as consumer, and examine instead the people of Britain—all the the people—producing and consuming and building our society as they go.

In particular, we need to make more films about the patterns of industrial organization, the complex patterns of manager, worker and consumer, and the economic and social relationships linking them. Ever since John Grierson's *Drifters* and Basil Wright's *Song of Ceylon*, British documentary film-makers have been finding the relationships between human beings and the processes of industry, and we need to extend this traditional skill to an examination of the relationship between the individual and the whole national and, indeed, international pattern of industry. And if there should be aspects of the industrial pattern that prove unattractive on examination, then we might move on a step from Sir Charles Snow and say that 'we cannot change this kind of society unless we understand it'. The film provides us with an opportunity to 'act out', as the psychiatrists would say, our hidden fears of industry!

With its ability to integrate into a meaningful whole so many diverse elements in picture and sound, and to condense or expand both space and time, the film can present many of the various patterns of life into which to-day's citizens must fit, and present them in such a way as to banish much contemporary ignorance and doubt. To bring into the light the mechanized monster from which so many are in rural retreat would be as healthy for industry as it would be for the public.

DISCUSSION

MR. G. VIVIAN DAVIES: Would Mr. Anstey agree that it is much more realistic in documentary films to have background noises than to have background music? I cannot help feeling that that film of the glass-maker would perhaps have been improved had there been a little background noise, as of grinding and so on. I believe it makes it more realistic to the audience.

THE LECTURER: Yes, I agree with that. In fact, in fairness to the final version of the film I should repeat here that I deliberately cut the track, because the commentary is not up to the standard of the visual and it may be that in the commentary there is some natural sound, which of course you were not able to hear this afternoon. That is my answer so far as that particular point is concerned.

In general I agree that natural sound is too rarely used, and music too often used, in documentary films. In my opinion, music should only be used for a carefully calculated purpose, to produce a certain emotional effect which is defined in the mind of the film maker; and for that reason it should practically never be used in technical instruction, where emotion is very secondary. It is a serious fault just to use music to fill in the silences at the back of commentary, and such music is almost bound to be completely inappropriate. It would be better to have silence in a case like that, but best of all to have natural sounds where there are any that are appropriate.

MR. P. K. SHAHANI: I was very glad to learn that the British Association for the Advancement of Science has decided to support the next Festival at Harrogate. That will certainly pave the way for closing that gap between science and industry.

At some stage the lecturer described industry as a 'spiritual wilderness', and in the course of his lecture he went on to show how films could be used for portraying the 'spiritual wilderness'. At no stage did he suggest how this 'spiritual wilderness' could be explored. Take the example of work study. The implications of work study, the human relations which arise out of work study, are very well portrayed in several films, but hardly ever are they used for the purpose of studying the work. What are the speaker's views on that particular problem?

THE LECTURER: Well, this is a difficult question to answer. At first I simply answer by saying I think it ought to be done. To say how it ought to be done of course would take a great deal of time, but I think that, given the necessary finance (and this of course is where the sponsoring body, whatever it may be, comes into play), and with an artist using the film medium, knowing that he can probe and analyse with his camera, that he can supplement his pictures with commentary, with music, with natural sound, and can integrate all these things into any pattern he desires—I believe that with all this you really can get something worth while out of the exploration of industry.

The point I am trying to make is that, given the artist's vision and the necessary tools, then one can explore industry. I agree that the most convincing demonstration of that would be to show you complete films where this has been done. They are still relatively few, I fear, though one can find examples. But, of course, I cannot this afternoon bring a whole lot of examples to bear. All I can state to you is the faith that it is possible, given the right film-maker and the equipment, to explore industry as one can explore any other field, and to bring the audience into a closer and more understanding relationship with industry.

MR. SHAHANI: Isn't the exploration more important than the portraying of industry?

THE LECTURER: I do not find any distinction between the two, because surely it is very difficult to portray industry without exploring it. If what you mean is the difference between a superficial view and a profound view then I agree with you, it is the profound, exploratory view one wants; but it was entirely on this assumption that I was talking; obviously one does not want just a superficial, outside view of industry. That could be not only worthless but perhaps dangerous. No, I think any examination, any portrayal of industry, must be an exploration of it.

THE CHAIRMAN: Mr. Anstey has given me a most exciting and thought-inspiring afternoon. We have been privileged to see something of the artist's mind at work in the extracts from films he has shown us, and I think also we have seen the mind of the artist at work in the speaker. I am sure we all felt that in Mr. Anstey we have a man with the real artist's feeling for his medium.

It always seems to me that industry, as a subject for films, is both exciting and photogenic. Mr. Anstey has spoken about real films; films about industry are real films to me; and if you have got somebody with Mr. Anstey's feeling, with the cleverness of a Jennings or a Flaherty to portray these things, then I never quite understand why films about industry do not draw a bigger audience. There must be thousands of people in the world like myself who would so much prefer to see that kind of film. This is by way of saying how much I have enjoyed the afternoon, and I believe you have shared my feelings. I am sure we are all deeply grateful to Mr. Anstey for his paper.

The vote of thanks to the Lecturer was carried with acclamation and, another having been accorded to the Chairman, the meeting then ended.

TECHNICAL EDUCATION: AN ASSESSMENT

A paper by

THE RIGHT HON. LORD NATHAN, P.C., T.D., D.L., P.R.G.S., F.S.A.,

President, Association of Technical Institutions, read to the Society on Wednesday, 21st January, 1959, with Robert W. Holland, O.B.E., M.A., M.Sc., LL.D., a Vice-President of the Society, in the Chair

THE CHAIRMAN: It is a pleasure and a privilege to be in the Chair on this occasion, when my friend Lord Nathan is going to talk to us on technical education. It is only by accident that I happen to be in the Chair, because I am a Vice-President of the Society; but having been associated with technical education, dare I say, for sixty-five years, I feel that I am privileged and entitled to say something in introduction of our speaker.

We who have been in technical education are all aware that it is one of those things which came from Scotland and came to this country to stay, but has taken a long time to grow up. I myself was privileged to be educated in the evening classes of a mechanics institution in the North of England. Most of you will remember that the educational side of the mechanics institution came through the efforts of Dr. Birkbeck, and at a later stage when the mechanics institutions were tending towards becoming social clubs, the then Society of Arts was invited to set examination tests on the various subjects taught in mechanics institutions. That was round about 1856, a hundred and three years ago. The Royal Society of Arts is proud to have this subject in its agenda because it was the first examining body setting technical papers.

The word technology was hardly known in these early days, but in 1879 the Society, acting as deputy assistant midwife at the birth of the City and Guilds, passed over the technical examinations to the City and Guilds and were left with what I am still pleased to call certain technical examinations, known as commercial, which have since been developed. You who are engaged in technical education all know that there is no special place for commercial subjects, except under the heading 'technical (including commercial)', when we deal with the Ministry of Education.

As a past member of the Association of which our speaker is now President, I am happy to introduce him to you as a former Minister of the Crown, as a great Solicitor, and a very valuable member of the Council of the Royal Society of Arts.

The following paper was then read:

THE PAPER

It is a great satisfaction to me to find myself speaking under the Chairmanship of Dr. Holland. I have the pleasure of serving with him as an active member of the Council of the Royal Society of Arts, of which he is a past-Chairman and a present Vice-President. We have also other points of contact, when we meet in other surroundings, on matters of mutual interest and concern. What I like about him most at this moment is to think that he is moving steadfastly with firm step towards the eightieth hurdle as I am about to take off for the seventieth.

Let me begin, if I may, on what you might regard as almost a personal note. When I was a very young man—to say 'young man' is to exaggerate; I ought to say when I was a boy—one of the leading figures in our public life was the famous Lord Curzon. He had been Under-Secretary of State for India, then he had been Viceroy of India, where he had made not only a great name but also a great stir: his Viceroyalty was famous in the constitutional history of the Empire and in the contemporary history of India. Then, on the expiration of his Viceroyalty, he came home to take his part in the Legislature here. When new governments were being formed, people would say, 'Why don't they send Curzon to the India Office?' Then I learned one of my first lessons in constitutional procedure and constitutional practice; the answer was, 'Because he knows too much about it'. Indeed it is, as many of you are aware, almost the unwritten law of our constitutional practice that those who know most about a particular subject should not be themselves appointed to hold a Departmental responsibility where that subject is concerned. I think my friend, the Chairman of Council, Sir Alfred Bossom, whom I see sitting here, and who is a long-standing and distinguished Member of Parliament, will agree that it has turned out in practice to be a sound principle. The idea is that a Minister should be a man without too much knowledge of the subject with which he is primarily concerned as Minister, but that he should be a man with experience of affairs, a man of judgment, able to assess and act upon the advice given to him by the experts who are there to advise him.

When I received a letter towards the end of 1957 inviting me to become President of the Association of Technical Institutes, the first thing I did was to write in reply and say, 'Are you sure that you mean *me*?' As the one to whom I wrote thus is here in this hall at this moment he will correct me if I am misleading you. The answer came back, 'Certainly we mean *you*'. As I reflected upon that answer I said to myself, 'This is another example of the working of our constitutional practice. I know nothing of the subject but at least there are those there who do whom I may consult.'

That leads me to say this: When upon my election as President of the Association of Technical Institutes I had to prepare a Presidential Address, I called it 'A Reconnaissance', and that was in truth what it was, because what I knew at that moment about technical education was all embraced in that one term of activity—'a reconnaissance'.

Since then I have availed myself of the experience that constitutional practice has established, and I have had the advantage of being able to see something for myself and of consulting with principals, with the Ministry of Education—the Further Education Branch of the admirable Mr. A. A. Part (an Under-Secretary in the Ministry), whose illness we all regret and at whose Honour in the New Year's List we all rejoiced—and also with academics. The result is that I have formed some sort of idea of the framework and shape, actual and perhaps prospective, of technical education in this country.

When, months ago, Dr. Luckhurst, the Secretary of this Society, invited me to speak here this afternoon, he asked, 'What subject?', and I said, 'Technical

Education'. He riposted, 'That is too wide: what do you mean?', so on the spur of the moment I answered, 'A prognosis'. I have since realized that that is rather a pompous and indeed even a presumptuous and a premature description for an Address by me, so I have altered the title and now call it 'An Assessment'—a far more modest term, opening the road to a good deal more manœuvrability; so that whilst I do not expect all of you to agree with all I shall say, I am hopeful that some of you may agree with something of what I say.

I believe the way that I with my make-up can best approach the subject is by dividing it into three parts: first, to take a brief survey of the structure of technical education, then to pause for a moment to consider some main features in the relations between technical education and industry, and lastly to take a bold leap into the dark as to what are the necessities, the possibilities and the likelihoods for the future.

So I begin with the structure of technical education. In that context there is, of course, to be considered first the structure of needs—industrial, technical and technological needs. If you look at them structurally you begin with ideas; ideas range from fundamentals to sheer, mere, gadgetry. Ideas are no use without interpretation: new scientific concepts must be translated into practical application in the shortest time and by the best and most economic means. When you have arrived at that stage, you develop into production, for which men and machines are required in the industrial context. And that takes one on to distribution, and, if you like, ultimately to social objectives. I think I say enough to cover what is immediately pertinent to the subject in saying that what I have mentioned are the irreducible yet expansive elements of the structure.

To achieve that structure certain widely varying and indispensable categories of workers are clearly necessary. You need scientists, particularly engineering scientists, whose main function is fundamental research. You must have technologists standing astride the two worlds of notions and production. You must have technicians, craftsmen, operatives, labourers, who are all needed in the industrial context, and then, of course, supporting and underpinning all these you require managements and commercial specialists.

When you move on from the structure of needs to the structure of means you come to the universities and the technical colleges, which operate in intersecting spheres of interest. I am not at all certain that the examination of intersecting spheres of interest is not amongst the most important tasks for all who are concerned with technical and technological education. By and large, the universities' special field is that of the administrator, political, industrial and commercial; the research scientists operating at the frontiers of knowledge, always seeking to push them forward; the teachers and the lecturers whose task is the dissemination of knowledge.

The structure of the technical colleges themselves has now been given a slightly new form; that structure is on four levels: colleges of advanced technology, regional colleges, area colleges and local colleges of further education. This structure looks likely enough to be adequate in conception, but it needs implementation in actual fact.

More colleges with adequate facilities are essential. The £100 million at present available for building and rebuilding will go a long way to achieve the object, but still more is needed. It is not without significance that the Hives Council in their Report in July, 1957, made the comment that 'no single college visited has accommodation which satisfies fully the Council's requirements'. That was in 1957.

What about the students and their courses? There has been a remarkable growth in the work of the technical colleges, and it certainly ought to be noted. The latest figures are only provisional and I am not able therefore to give any precise figure, but you may, I think, assume that as compared with 1950–1, when there were 39,000 full-time day students, and 1955–6, when there were 55,000, this past year the number has crept pretty steeply up. As regards part-time day students at the technical colleges—in 1950–1, 257,000, and in 1955–6, 400,000—there has also been a significant improvement. The evening students have a place all their own. It is fair to say that in general the trend is satisfactory; some would think in many of its aspects highly satisfactory.

There has been, too, a marked and encouraging increase in the numbers released by employers for part-time day instruction—from 190,000 in 1947–8 to 384,000 in 1955–6, and happily the curve is still rising.

A recent development includes the establishment of a First Award, the Diploma in Technology, generally known as Dip. Tech. The course for Dip. Tech. may be full-time or sandwich—that is six months in college followed by six months in industry for a period of four years—but the courses must not be part-time or evening; they must include industrial experience before or during the course.

I want to say something specifically about technicians as such: they, of course, have their essential—indeed, their indispensable—part to play in the whole of this great enterprise. I do not know how much consideration has been given by those now actually engaged in the formulation of and giving effect to plans for education and training in the technical-technological fields to the definition of a technician—what, that is, a technician should be and what he should do. It is a term which is often used rather loosely. I am interested in the definition authorized by the Conference of Representatives of the Engineering Societies of Western Europe and the United States in 1953 and by the Commonwealth Engineers' Conference in 1954. This is their definition of a technician; it is rather long, but I think it is worth while:

> An engineering technician is one who can apply in a responsible manner proven techniques which are commonly understood by those who are experts in a branch of engineering or those techniques specifically prescribed by professional engineers.

Then it goes on to say:

> Under general professional engineering direction or following standard engineering techniques he is capable of carrying out duties which may be found among the list of examples [which I will indicate in a moment]. An engineering technician requires an education and training sufficient to enable him to understand the reasons for and the purposes of the operations for which he is responsible.

Now these are some of the duties that are typical of those carried out by engineering technicians; they are formidable in their range and in their importance:

> Working on design and development of engineering plant and structures; erecting and commissioning of engineering equipment and structures; engineering drawing; estimating, inspecting and testing engineering construction and equipment; use of surveying instruments; operating, maintaining and repairing engineering machinery, plant and engineering services and locating defects therein; activities connected with research and development; testing of materials and components; and sales engineering, servicing equipment and advising consumers.

That is an impressive list of accomplishments for the technician who has to take, not the foremost place in this business of technology, but at all events a most prominent and an indispensable place.

We cannot improve our position without more technicians, but to improve it we need more technologists. The future will see new courses specially designed for technicians. It is quite clear that we cannot go on getting our technicians merely by upgrading good craftsmen and downgrading poor technologists.

It looks as if the sandwich courses to which I have referred will ultimately replace the one-day-a-week course, and that will be, I think, greatly to the good.

A few months ago, at a Summer Conference of the Association of Technical Institutes at Bath over which I presided, Dr. Ethel Venables read an illuminating paper on the percentage of failures as compared with those who were able to pass and get the National Certificate. I think this extremely important in the whole not-too-easy business of inducing young people to come and train as technicians in industry and remain as such. These Industrial Certificate courses were originally introduced to provide a ladder from the shop-floor to the professions. They need now—it is indeed a good deal overdue—a complete recast in order to make them suitable for technicians of varying grades of intelligence and varying educational backgrounds. I believe that on a long view it is more important to industry in attracting the youngster to become a technician and to the morale of the young technician that he should pass a test fitted to his capacity than fail in one beyond it. The reason why there is so disquieting a proportion of failures is that they are not nicely adjusted to the capacity of those who are to take the examinations. I believe all that wants looking at carefully: the solution may lie in an appropriate grading of the examinations to match the standard of the entrants, and to divide the Certificates into appropriate classes accordingly.

I pass now from this brief, and, to many of you, elementary, survey of structure to other considerations, principally the relations between technical education, technological education and industry.

If you take a careful look at British technical education, whether at the advanced or any other level, it must be appreciated that co-operation between the colleges and industry, not only as regards the supply of students but also through the identification of the kind of course recognized, the elaboration of syllabuses and the provision of staffs and equipment, is of the first importance.

At the technological level the development of new courses has made this

partnership more close-knit than ever. Indeed, this attunement to the needs of industry may be the feature of the advanced work in a technical college which chiefly distinguishes it from university work.

There are 263 sandwich courses; the great majority of these are primarily works-based. The organization of such a course involves, naturally, the principal and the appropriate heads of department in prolonged discussion with representatives of the firm in question. The entry conditions, the method of selection, the time and dates for periods of study, the level of the final qualification must all be discussed, and most important of all, arrangements must be concerted to ensure that the practical training of the student in the works and in the college forms a single integrated whole. If the final qualification is to be the Dip. Tech., the National Council of Technological Awards will wish to be fully satisfied about this relationship between work in the works and work in the college. Also—and vastly important—arrangements have to be made for college staff to keep in touch with students during their works periods.

All this is a completely fascinating field for development. I doubt whether the full implications are really appreciated; they are worthy of exploration. The importance for the staffs of the technical colleges of this close connection with industry was particularly stressed in the Report of the Willis Jackson Committee on the supply and training of teachers for technical colleges, published in May, 1957. The Committee's attitude was summed up in these words: 'There must come to be a much greater interchange of staff and ideas, and it must become a commonplace for individuals to move from one domain to another and back again and for them to be fully recognized members of both at one and the same time'.

It is perfectly true, as any observer will readily appreciate, that this mobility is still hard to find; it has not been fully or completely or even satisfactorily worked out so far. For a variety of reasons, but mainly owing to the shortage of staff, teachers have not to any great extent availed themselves of the opportunities offered to them to return to industry for refresher periods of up to a year. It is to be hoped that this practice will increase.

Meanwhile, the day-to-day organization of sandwich courses has been bringing more and more teachers into close touch with industrial personnel, and there is at least one example in a college of advanced technology of a head of department being a part-time director of an industrial concern. I think that is worth noting.

The close connection between the colleges and industry receives further recognition in the development of research and post-graduate studies in the colleges. Encouragement for research in technical colleges was given by the Minister of Education as early as 1946. Facilities for research were indeed in the nature of a condition for those which applied for a 75 per cent grant. Later it was decided that colleges of advanced technology should develop a substantial amount of research, and particularly research sponsored by industry.

I do not believe there is any ready means of measuring the progress made in this direction. Undoubtedly, there has been considerable activity not only in

colleges of advanced technology but also in many regional colleges. Much individual research is carried on by the staff of the college, either the full-time teaching staff or research assistants specially appointed on a short-time basis, usually to work for higher degrees. Many colleges also conduct research in association with an industrial firm or research organization, and grants have been awarded by the Department of Scientific and Industrial Research for specific projects. In general, the research carried on in technical colleges is not so much pure scientific research as applied research, in that it has as its aim the furtherance of knowledge about specific industrial processes and techniques. The difference between applied research and fundamental research, of course, goes to the root of the matter. A recent event of significance was the announcement only last November (1958) by the National Council of Technological Awards of the institution of an award higher than the Dip. Tech.—in fact, not only higher than the Dip. Tech., but known colloquially as 'Dippier Tech'. In their statement the Council declared their belief that a principal object of any higher award should be to stimulate the recognition and investigation of problems which are related to the needs of industry. The higher award, therefore, was to be a mark of outstanding distinction granted to a student for a programme of work successfully carried out jointly in industry and a technical college, and extending over a period of perhaps three years. The period spent in college could be taken up either by research or by an advanced course of instruction, or by a combination of the two.

The award is to be membership of the College of Technologists; in short, M.C.T. The Council declared their intention of establishing the College and promised that further details would be announced as soon as possible. We are waiting for them. It was expected by the Council that study leading to the higher award would not follow immediately upon the award of a Dip. Tech.; an interval of a period in industry would normally be expected. The Council went on to say that they attached the greatest importance to students maintaining close contact with industry or commercial laboratories, but that they were prepared to administer the scheme flexibly and to recognize special arrangements for teachers and even for some students in technical colleges. They did not, however, propose to grant an award solely on the basis of advanced courses of instruction in technical colleges; it was not envisaged that only holders of the Dip. Tech. would qualify for the Dippier Tech.; rather, it was hoped that just as holders of the Dip. Tech. might choose to continue their studies for a higher degree in a university, so university graduates might wish to register as candidates for the M.C.T. There should be a two-way traffic. The vice-chancellors and principals of universities have commended this to their universities; and that is a very gratifying feature.

No reference to post-graduate work in the colleges would be complete which did not mention the advanced short courses for specialists already employed in industry; these are provided on an increasing scale year by year. These courses usually consist of a series of weekly evening lectures on subjects ranging from, shall we say, 'Recent developments in machine tool design' to computor pro-

gramming or the design of nuclear reactors. A list of courses is compiled by each Regional Advisory Council and passed to industry and the professional bodies concerned in the various localities.

What about the further outlook? By the end of 1958 the technical colleges were producing more highly qualified people than at any previous time in their history. Instead of the 1,500 a year postulated by the Percy Committee in 1945, the colleges in England, Scotland and Wales produced in 1957 a total of 6,300—four times as many—scientific and qualified engineers. The expansion at the non-advanced level has been equally great and equally vital to the well-being of the country. The supply of suitable teaching staff is a basic condition for this development. So far as overall numbers go, the figures available at the end of 1958 were not discouraging.

Yet numbers are far from being the whole story. The colleges are still having great difficulties in recruiting the really high quality staff required to fill key posts at the head of departments, and those of you who are principals of colleges will agree, I think, that that is a most formidable problem. Men and women of the quality required in the expanding colleges will only come forward if they see that the colleges can offer a distinctive 'way of life', offering advantages and a status comparable with, though different from, those offered by the universities, and providing in particular opportunities for keeping in touch with industrial development, for accepting consultancy work, for developing professional contacts and continuing technological studies and research.

In May, 1957, the Ministry of Education suggested that one way of 'humanizing' technical studies was by relying less on formal lecturing and more on tutorial methods, akin to those practised in the older universities. The development of such methods for the growing number of advanced students in the technical colleges will be a task of considerable magnitude and will involve big increases in staff. Yet that it is a worth-while and indeed essential task if technological study is to become a medium for a full education, is not open to doubt.

There is need for serious thought about the steps which could be taken towards this end. It is to be hoped that the technical colleges will in the future be distinguished not only by their close association with industry at graduate and post-graduate levels, but also by their careful teaching and their attention to the personal needs of individual students—much depends on that.

I now come to the part of my 'Assessment' which is perhaps in the realm of theory, conjecture and suggestion rather than more or less a statement of facts. What are we up to? What does the future hold? Whither do we go? How are we going to get there? What are we going to do about it?

With the rapidly increasing rate of industrial expansion at home and the industrialization of vast areas of undeveloped and under-developed countries, the need for specialists technologically trained at all levels becomes altogether imperative. Indeed, the number of available technologists will be the rate-determining factor of this expansion and, therefore, the rate-determining factor of the British contribution towards it.

In which fields are technologists and specialists likely to be particularly needed in the course of the next decade or so? The simple answer to this question is 'In all fields'.

The industrialization of the under-developed countries will make heavy demands on technologists in what one might call the 'classical' industries: mechanical engineering; civil engineering, such as road, house and bridge building; agricultural engineering; machine tools, and the like. In addition to these there are several new industries, which we ought to have a look at, which will undoubtedly expand greatly and make heavy calls on technological manpower.

What are the principal of these new industries? What are the opportunities they offer, both to the welfare of the country, its place in the world economy and the employment of highly skilled technologists and technicians? I will take two or three of them.

First, there is the *Electronics Industry* in all its various aspects, such as all kinds of automation for process control, particularly in the mechanical industries; different kinds of instrumentation with automatic recording; calculating machines for different purposes—insurance, calculation of the various taxes, population statistics, and so on; television and radio; aeronautics; and ballistics. There is a whole new range growing up under our eyes.

Then there are the industries based on *Chemical Engineering*, such as the production of new plastics and fibres; fine chemicals; solvents from petroleum; fertilizers from natural gases; the biochemical industry—anti-biotics; histamines; hormones; pharmaceuticals—metallurgy—new alloys for aircraft, guided missiles, and so on.

Then there are the industries based on *Nuclear Engineering*, particularly concerned with the design and construction of nuclear power stations.

And there is, of course, *Aircraft Production*.

All these industries will need technologically skilled manpower of all grades, at the technological as well as at the academic end.

The standard of technological education in our technical colleges and universities is very high. I have recently had—and greatly appreciated—the opportunity of visiting the famous M.I.T., the Massachusetts Institute of Technology, and of talking at length with its Principal, and seeing for myself something of the buildings and equipment—magnificent buildings and superb equipment. But still, from what I have observed, and been told there, and from the information I have had from those from whom I have inquired, it would, I think, be just to feel not only that the standard of technological education in this country in our technical colleges and universities is very high, but that it bears favourable comparison with and is in a variety of respects probably higher than the standard anywhere else in the world.

Technological education needs broadening into the new fields of technology, and above all a very considerable numerical expansion; many more technicians and many more academically trained technologists must be produced. With regard to the technician, specialists will be in increasing demand over a long

period of time as draughtsmen, electronics technicians, skilled fine mechanics, chemical technicians, micro-biologically and bio-chemically trained technicians, and glass blowers. This country produces excellent fine mechanic and electronic technicians, but not enough. There is a great shortage of good glass blowers. And we are very backward in nearly all fields of chemical technology, in particular in the new bio-chemical industries, such as the production of anti-biotics and other bio-chemicals, and in the food industries. Facilities for the practical training of electronic technicians and fine mechanics exist in the technical colleges, but space for them must be increased.

For the bio-chemical industries, such as the production of anti-biotics, no adequate training facilities exist as yet, and they must be created without delay. We have lost—or rather failed to make—not millions but hundreds of millions of pounds sterling which were within our grasp, by short-sightedly allowing the anti-biotic industry to go to the United States, taking no great interest in it ourselves. We must do what we can now to catch up.

The number of teachers must be increased proportionately to the number of students to be trained. It is essential, however, to take great care that in the physical expansion of training facilities, the educational standard is not lowered.

In addition to providing the purely professional technological training and background, it is important to ensure that the students are acquainted with some of the problems created by the human environment in which they have to work. Students have to be taught a sense of responsibility and pride for the work they are doing, and to understand the spirit of team-work, to learn the functioning of the organizational hierarchy, and with it the proper attitude towards superiors and subordinates: they are all members of a team. In the future there is not going to be so much room for individuals; there is more than ever going to be room for individuality.

With regard to the requirements of the next decade for academically trained scientists and engineers, very much the same conditions apply. Academically trained scientists will be required in all the fields of industry to which I have referred and, of course, in others too—many more. Whereas in the technical colleges the main emphasis must of necessity be on the manual techniques, the academically qualified engineer or industrial scientist must be given a theoretical background of the highest standard. It will be his ingenuity and his originality to which we must look for new inventions and new technological developments. He must, therefore, be imbued with the spirit of pure research, even though he will ultimately be concerned with the more practical types of work. This is of importance for all sections of the engineering sciences, but of special significance for the new fields of nuclear engineering and instrumentation, for which physicists of the highest calibre are required, and for the fields of chemical engineering and, in particular, bio-chemical engineering, which have been much neglected in this country. In fact, until a relatively short time ago chemical engineering was not considered a proper science at all in this country, with the result that nearly all the major developments in that wide and rewarding field were made in Germany and the United States. As I have said, they have reaped the rich

reward which was there open for us, for the inventions were British, but alas, the application and the profit were left to the United States.

If this country can maintain the present quality of its industrial scientists, engineers and technicians, and at the same time increase their numerical strength, it will be in a very favourable position to compete with the two great mass producers of technologists: the United States and the Soviet Union. If we have not done so badly up to now with a greatly inferior number of scientists and technologists, this is due to what I have stressed before: the very high quality of technological training in this country. That quality can and must be maintained, indeed improved. If we move forward resolute about that, we can, I believe, with sober confidence, face the future.

DISCUSSION

THE CHAIRMAN: As Chairman I am privileged to offer comments on our speaker's address, but I feel that I should not at this stage comment at all, because to do so would be to pick and choose little points that appeal to me or that I reject, and in consequence I might spoil the picture that some of you have got into your minds. I want to see this address in type so that I can see the whole picture, and I should like to browse over it—but then it will be too late to comment on it.

Lord Nathan has undertaken to answer questions, and it is now open to members of his audience to comment or inquire.

MR. P. K. SHAHANI: At the beginning of this month, at the Oxford Conference for Schoolmasters, Lord Verulam said that textbooks should not be allowed for use in science and technical examinations. He said that 'the intellectual shortcomings of the candidate who made too much use of the book would soon be detected, and in any case he probably would not finish the paper in time'. If the procedure which Lord Verulam suggested were adopted, it would broaden the capacity of the individual and would ensure that the libraries in schools, colleges and universities were designed to be fully used for reference as well as for profound reading. Does the lecturer agree with this view?

THE CHAIRMAN: I am afraid the lecturer did not quite grasp what the question was; and also, I am of the opinion—and I do not know what those in the body of the hall think—that the question is not entirely within the compass of the lecture that has been given.

MR. SHAHANI: Mr. Chairman, technological education suffers from something which is more basic than getting more teachers or having an interrelation of students with industry. There is something much more than that. It is the access that students should have to textbooks, rather than just cramming them. I should like to ask the speaker's views—whether he agrees that textbooks should be allowed in science and technical examinations.

THE LECTURER: I was really rather disturbed because I thought the questioner was quoting from me, and I was relieved when I found he was not. Nevertheless, I would not dissent from the essential necessities of textbooks in the right place for the right people.

MR. H. A. WARREN: May I, as a fellow member of the Council with Lord Nathan, add a very sincere tribute to this most comprehensive and interesting address which we have heard. I can assure Lord Nathan that for those of us who have been in

technical education for many years it has been a most valuable and significant contribution.

I was listening, however, for one opinion from his Lordship on a very deep point of principle, which I have had with me and puzzled over ever since I had the privilege of seeing many famous Continental institutions; that is the principle of *poly*-technic or *mono*-technic, of *poly*-grade or *mono*-grade—and by grade I mean the standard of work.

A few years ago it was nothing uncommon, more especially in provincial technical colleges, to find degree work, national certificate work, City and Guilds courses on how to mend boots and shoes, and a conference of matrons of day nurseries, all going on in the same building and under the same administration. Such a combination could be called polytechnic and multi-grade in that some courses were doing degree work and some were engaging in very valuable but quite different adult education.

I have come to the conclusion that one of the most successful features of the more advanced Continental institutions is that they are often much more *mono*-technic than ours and nearly always *mono*-grade. An English technical college would have to be split up into perhaps as many as sixteen different buildings to achieve a one-grade, one-faculty unity of purpose. There are advantages and disadvantages; it is not my task to enumerate them. I should, however, like to ask the lecturer whether he has pondered that question and whether from his world-wide experience he would veer towards the 'mono' side or the 'poly' side.

THE LECTURER: My friend Mr. Warren is sitting next to the Head of the Polytechnic; so how can I, with those two sitting side by side in front of me, take sides? However, I have had the opportunity, as Mr. Warren will remember, of visiting with him his own college, which is 'poly' rather than 'mono'.

On the whole, I think in the world unto which we are moving, with the high degree of specialization required—though I speak subject to many qualifications—my own inclination would be in favour of 'mono' rather than 'poly'; I mean, of course, for particular purposes in the field of technology.

MR. W. F. GIDDINGS: Mr. Chairman, I was very interested in Lord Nathan's reply to that. I think we would say that the recent developments in the district of Acton between Acton Technical College and the Brunel College of Technology have, in fact, been a move of the type just mentioned, certainly a move towards *mono*-grade.

As regards his Lordship's address, I was particularly interested in the definition he gave us of technicians, and having listened to that definition I should like to ask this: I am rather concerned about the question of the training of technicians to cover that field of work. When national certificates were first introduced and were sponsored jointly by the Ministry of Education and the professional institutions, the professional institutions were very generous in the recognition they gave to those certificates with their own examinations. As time has gone on there has, as a result—I think this is a fair statement—been an increasing tendency for colleges to allow that recognition to influence them too much in designing their national certificate courses. Would it not be better now if the professional institutions—as the Institution of Electrical Engineers has done to some extent already—were to do more to indicate that, as far as they are concerned, in the future national certificates will not carry any such exemption? The national certificates could then be redesigned purely from the point of view of the training of technicians, and the other courses which have been mentioned to-day, the sandwich courses, could deal with the question of the technologists. There is still the ordinary national certificate level at which the exceptionally promising type can be creamed off into the other stream. I think one Institution, as I have already mentioned, has made it fairly clear that that is what it envisages for the future, but I do not think even they have yet come out in the brutal entirety.

THE LECTURER: I think that was rather a pronouncement than a question. It was very interesting.

MR. GIDDINGS: I should like to know if you agree that that would help in the training of technicians.

THE LECTURER: I think I indicated that it looked to me as if the whole basis of the National Certificate wanted recasting, and it is very important that the certificate should be related to a varying degree of capacity and differing sets of facts and techniques. Mr. Giddings made rather a long statement and I agree up to that point.

I would also say that it seems to me that unlike most boundaries and frontiers, which are supposed to be precise and definite, it is well that the boundary between the technician and the technologist should remain a somewhat blurred boundary, not too closely or accurately or completely defined, so that there can be a passing across the boundary even though you may not know you are across the frontier at all—until you find yourself there.

We have spoken on the same platform in this very hall before, at a conference upon apprenticeship in July, when I sat, Mr. Chairman, in the Chair you occupy to-day. I am sorry not to give you a full and complete answer: I have answered according to my capacity. If you feel I have not done so, would you tell me, and I will try and improve?

MR. GIDDINGS: I think, Sir, the specific point I am trying to get at is this: do you feel that the institutions, in continuing to try to allow as much recognition as possible from their own examinations to the national certificate holder, are encouraging a tendency for national certificates to be too much biased in their design towards professional recognition instead of concentrating on the main job of training technicians?

THE LECTURER: That would be my impression.

DR. O. G. PICKARD: During a visit which I was fortunate enough to make to Scandinavia last summer I had the opportunity of seeing some of the technical colleges in Norway, Sweden and Denmark. I was very impressed with the amount of research work going on in these colleges and I was able to discuss this with the people in charge. I found people there who were quite familiar with technical education in this country. One of the criticisms they made of it was that not nearly enough research work was being done in technical colleges, and they thought it was wrong that the Department of Scientific and Industrial Research, as it seemed to them, is so completely divorced from technical education. What they meant by that was this: in some technical colleges in Scandinavia you can find the equivalent of a D.S.I.R. research station in the college and the teaching staff have their duties divided between teaching and research work at that level. The results, they claimed, were that the teachers were always completely *au fait* with the latest research going on in their field.

I do not know whether Lord Nathan would like to offer any comments on the relationship between the D.S.I.R. and technical education in this country?

THE LECTURER: I think what Dr. Pickard has said is extremely interesting and important. Whilst I have not had any opportunity of personal observation, I am aware of the high degree of excellence which prevails in Norway and Sweden in technological education. In this technological world at this particular time I believe there must be not so much a blurring of frontiers—which I referred to just now—between technicians and technologists, as a certain blurring between technologists and university research workers, although I think they should probably be less blurred in that quarter than in the other.

I am not at all certain that I cannot answer Dr. Pickard's question by saying this: it seems to me that your research student in a technological college will be engaged upon the working out of specific industrial problems which cannot be worked out in the works at all, because they are too complex. But these problems may have a much wider application, and if the technologist research student in the college and the departmental head—or whoever it may be in the works who is concerning himself with a particular problem—were to come together for a period of time, say three years, as I mentioned in my paper, in order to examine it and find a solution to the problem which commended itself in actual practice in industry, very much what Dr. Pickard wishes to achieve might be achieved.

DR. PICKARD: May I add a supplementary? Another thing which impressed me very much about Scandinavian technological achievements was the work and status of industrial designers in those countries. This is apparent whether you are looking at Danish furniture, Swedish-designed motor lorries or Norwegian-built ships, and I wonder whether Lord Nathan would like to offer any comments about the training of industrial designers in this country?

THE LECTURER: I do not think I feel qualified to answer questions on industrial design. After all, associated with us here in the Royal Society of Arts are those who are the foremost experts in that subject. I would sooner that you put that question to them or that I should have the advantage of trying to obtain from them the information because, as I told you, I have been seeking information from all who are ready, willing, able and competent to give it, which they have been so kind as to do. That is not one of the subjects upon which I feel any competence to speak.

MR. H. FALKNER (Principal of Croydon Technical College): Having much appreciated Lord Nathan's exposition of technical education as it is to-day, and feeling that few things could be more technical than technical education, I should very much welcome his comments on its place in the structure of education generally. For instance, his case for technical education is, I believe, so vastly different from primary and secondary education that I wonder whether he really feels—since it is incorporated with education generally, being organized by local education authorities, being subjected to the whims and fancies of local government—that it is in its right niche as it is at present.

THE LECTURER: I am very glad that question has been raised by Mr. Falkner. I said in my opening observations that my first approach to this whole problem had been 'a reconnaissance' and that to-day, as a result of that reconnaissance, I would attempt an 'assessment'. I think that the next phase—if there is a next phase—will be 'deployment'. That brings up the whole question of the place of technical education in the educational system as a whole and I should prefer to leave it at that if I may. If I should be asked again and on the next occasion Mr. Falkner and I meet, I hope I shall then have said something which will prompt the same or a similar question from him.

DR. L. E. C. HUGHES: I think one of the reasons for the paucity of scientists and engineers in this country is the low esteem in which they are held, particularly at the public schools and the older universities, a situation which is fortunately changing. It is only since the war that this situation has improved, the country's future and defence depending so much on technologists, both in quantity and quality. In some countries engineers and scientists have a real professional status, by being registered by law, just as nurses, doctors, architects and opticians are here. Perhaps your lordship would indicate whether the future supply of such individuals would be improved by such registration as obtains in Australia and other parts of the Commonwealth. There must be many who, in choosing a career, do in fact look to

future remuneration and status as a determining factor, and do what they want to do rather than what is good for the nation. Accountants and lawyers (when successful) do seem to have a far better life than scientists and engineers, while doing nothing creative towards the wealth of the nation.

THE LECTURER: That is an interesting question and I think it really fits in very much with what I said just now about an examination into the wider field of practicalities. With regard to registration, it is not only a question of getting registration for some undefined purpose, it is partly a question of whom you are going to register, with what qualification and to what end? I do not think public registration itself will take one very far; one also has to consider the various professional organizations and the qualifications and status which membership of those organizations gives.

I think the question Dr. Hughes has put fits rather naturally into what I would call the next stage, as far as I am concerned, in looking into the matter further; that is, not stopping still where I stand now, but the stage of deployment. I think that deployment may perhaps be rather an apt word to cover what we are thinking about.

THE CHAIRMAN: We are under a great obligation to Lord Nathan for having spoken to us this afternoon on such a wide subject and we are grateful to him also for answering questions, which for the most part I was unable to catch—there again it is evidently that question of antiquity! We are grateful to you, Sir, for your address and for the way in which you have handled the questions submitted to you. I am sure we all look forward to the time when we shall hear Lord Nathan again talking about deployment, his third adventure into technical education, and he has certainly got a job.

The vote of thanks to the Lecturer was carried with acclamation, and the meeting then ended.

ROAD DEVELOPMENT IN THE OVERSEAS TERRITORIES

A paper by

R. S. MILLARD, Ph.D., M.I.C.E.,

Head of Tropical Section, Road Research Laboratory, D.S.I.R., read to the Commonwealth Section of the Society on Thursday, 15th January, 1959, with Sir Reginald Taylor, C.M.G., M.I.C.E., Engineer-in-Chief, Crown Agents for Oversea Governments and Administrations, in the Chair

THE CHAIRMAN: The Road Research Laboratory of D.S.I.R. plays a most important part in road development in this country, and a great number of the methods and processes that you see in use all over the United Kingdom are the results of its investigations. A few years ago the Laboratory formed a section to deal specifically with road problems in the Colonial territories, and recently the scope of this section has been widened to include the territories which are coming independent. Dr. Millard is the head of this section of the Road Research Laboratory and is very well equipped to describe to you what is happening in regard to road development in the overseas territories.

The following paper, which was illustrated with lantern slides and demonstrations, was then read:

THE PAPER

HISTORICAL

When my colleague, Mr. Atkinson of the Building Research Station, addressed you on 'Housing and Building in the Commonwealth', in 1957, he had the advantage that it is possible to trace the historical development of architecture and building in the overseas territories from the time of the first European contacts and in some instances even before this. My task is easier in that the development of roads in almost all territories is a matter of very recent history. It is true that we found in India a reasonably well-developed system of cross-country land routes, but these were little more than tracks suitable for pack animals. Our development of them was mainly one of military necessity. In this era, and indeed until the 1920s, roads were not generally thought of as instruments of economic value or even as aids to social intercourse. One notes with delight one exception in Jamaica where, in 1908, an itinerary of the main roads was prepared by the Public Works Department to encourage tourists to view the unrivalled beauties of the island.

In the main, though, roads were normally built for tactical or administrative reasons. Such, for instance, was the first wagon road from the East African coast to Lake Victoria. This was built in 1895–6 by a party of Royal Engineers under Captain G. E. Smith, R.E., whose instructions were to build a road 'of the simplest kind, unmetalled, and in fact the roughest track along which a bullock-cart would go'.[1]

The Mackinnon road from Mombasa to Kibwezi had been built some years earlier. Smith continued from Kibwezi up through the Athi plains, down the Kikuyu escarpment and, finding a new route through Eldama ravine, to the summit of the Mau plateau and on to Port Victoria on the Lake. This enterprise is the more historical in that at the same time Smith undertook the first accurate triangulation survey of the country. Amongst other adventures the party disposed of a man-eating lion whose carcase provided fat to keep the axles of their carts well greased for about six weeks.[1]

The great period of colonial expansion in the nineteenth century coincided with the development of the steam train and it was natural that railways should be employed as the main means of opening up new territories. Few people anticipated that the growth of motor transport would become one of the main forces in social and economic development. As late as 1927 Lord Lugard believed that the motor lorry would not prove suitable even for carrying produce to the nearest railhead.[2] He and others were thinking of the possibilities of overland vehicles which did not need roads. Inspired no doubt by the success of the tank in the First World War, many Colonial administrators were then considering the possibilities of large vehicles either with tracks or very large wheels, carrying loads of up to 100 tons and towing strings of trailers. Here can be seen an attempt to compete with the railways on their own ground. Practical trials with metal- and rubber-tracked vehicles were made by the Empire Cotton Growers in Nigeria. In the early 1930s the Empire Marketing Board sponsored the development of heavy tractor and trailer units capable of carrying up to 40 tons, and it is worthy of note that the Governments of Australia, New Zealand, Southern Rhodesia, India and the Sudan were sufficiently interested to make grants to help in this development.[3]

MODERN TRAFFIC ON ROADS OVERSEAS

Since then the line of evolution of overland goods transport has divided. Its main stream has led to the development of compact lorry and trailer units, used for long- and short-distance haulage of goods rapidly over well-made roads. A subsidiary stream has produced such vehicles as the Sno-cat, the Swamp-skipper, and huge overland trains with large low-pressure tyres, vehicles of outstanding mobility in special conditions, but of little practical value in normal commerce.

Most territories are well past the stage of pioneer development in which such vehicles might find uses. The normal vehicle is already there. In many places it is proving cheaper and more convenient than the railway even for long-distance haulage. But its main impact is on the social life of the people; like the bicycle and the sewing machine, it has brought new and exciting prospects into their daily life. The mammy wagon loaded with West Africans and their goods, hooting its progress from village to village, is evidence enough of the social value of motor transport.

This growth in the use of motor vehicles has been greatly accelerated since the war, as can be seen from the statistics of licensed vehicles and fuel consumption quoted below.

TABLE I

	1948	1951	1953	1955	1957
	VEHICLE REGISTRATIONS				
British Guiana ...	3,190	5,483	7,710	9,817	14,006
Nigeria	17,478	29,283	37,788	43,500*	47,500*
North Borneo ...	835	2,292	2,677	3,532	5,019
Northern Rhodesia	10,000*	14,500*	20,000*	31,964	42,059
Trinidad	13,170	23,492	27,781	32,262	40,154
Uganda	7,257	12,213	17,208	27,950	33,379
Union of South Africa	564,000	662,000	727,000	809,000	—
Great Britain ...	3,734,000	4,626,000	5,341,000	6,412,000	7,427,000
	MOTOR FUEL CONSUMPTION (thousands of gallons)				
Nigeria — Petrol	14,005	23,966	33,327	39,554	46,253
Nigeria — Diesel	3,339	6,773	10,755	15,221	27,203
Total ...	17,344	30,739	44,082	54,775	73,456

* Estimated

Thus the number of road vehicles in most overseas territories has recently been rising each year by between 17 and 25 per cent. In Great Britain over the same period the average increase has been 8·5 per cent per year. This is as would be expected; the greater the prospects for development, the more rapidly will development proceed. The usual index of the increase in road traffic is derived from the number of vehicle-miles travelled, because this is the figure which indicates how the overall density of traffic is increasing. In Great Britain the yearly increase in vehicle miles travelled is 6·3 per cent. No precise figures are available for the overseas territories, but the figures of motor fuel consumed in Nigeria suggest that the yearly increase is there of the order of 15 per cent.

The rate of increase of traffic varies greatly on different roads according to local circumstances, but the figures quoted below for two roads, one in Uganda and one in Nigeria, illustrate the general trend.

AVERAGE NUMBER OF VEHICLES PER DAY

Road	1951	1952	1953–4	1954–5	1955–6
Mbarara-Lyantode road, Uganda ...	44	127	150	186	225
Shagamu-Ijebu-Ode road, Nigeria ...	148	147	281	399	—

TABLE II. ROAD STATISTICS FOR THE OVERSEAS TERRITORIES

(latest complete figures are normally for 1956)

Title	*Great Britain*	*Total Overseas Territories*	*Selected Territories*						*U.S.A.*
			Nigeria	*Uganda*	*Nyasaland*	*Hong Kong*	*N. Borneo*	*Jamaica*	
AREA, sq. miles	87,815	1,874,000	373,250	93,981	49,177	391	29,387	4,411	3,022,387
MILES OF ROAD	189,000	150,000*	37,033	11,100	5,152	443	702	2,645	4,173,492
Road miles per sq. mile ...	2·15	0·08	0·10	0·12	0·10	1·13	0·02	0·60	1·38
POPULATION	49,812,000	80,000,000	33,368,000	5,593,000	2,600,000	2,583,000	383,000	1,570,000	168,091,000
Population per sq. mile ...	567·2	42·7	89·3	59·5	52·9	6,606	13·0	355·9	55·6
NATIONAL INCOME‡ (£s million)	£18,117	£3,350	£735	£134	not known	£245	£63	£141	£147,286
National Income per head‡	£364	£42	£22	£24	not known	£95	£100	£90	£876
NATIONAL REVENUE (£s million)	£5,819	£515	£66	£19	£6	£32	£5	£22	£38,429
Expenditure on Construction & Maintenance	£110,000,000	£20,000,000**	£2,362,000†	£373,000†	£1,225,000†	£1,238,000†	£128,000*†	£1,028,000†	£2,605,000,000
Expenditure on Construction & Maintenance as a percentage of National Revenue	1·9	3·9	3·6	2·0	19·0	3·9	2·6	4·6	6·8
NO. OF LICENSED MOTOR VEHICLES	6,917,000	455,000**	43,500*	30,312	7,335	25,000	4,380	27,538	64,437,000
No. of persons per motor vehicle	7·2	175·8	767·1	184·5	354·4	103·3	87·4	57·0	2·6
No. of vehicles per road mile	36·6	3·8	1·17	2·7	1·4	63·9	6·2	10·4	15·4

* Approximate figure.
** Very Approximate.

† Excludes road expenditure by urban road authorities.
‡ Figures for overseas territories are approximate.

To the road builder this increase in traffic has coincided with the change from the bush track, laboriously cleared and maintained by hand, to the properly constructed road, needing all his skills in location and in design, and needing modern machinery to build it and keep it in good condition. One still feels a tinge of adventure in setting out to motor from Johannesburg to Capetown or from Kuala Lumpur to Singapore: still more from Arusha to Dar-es-Salaam or from Kano to Lagos. But these and many other long-distance road journeys can be undertaken as matters of routine. Much of this has been accomplished during the past thirteen years since the war. Over this period road construction has taken the greatest single share of Colonial Development and Welfare funds, some £32 million out of a total of £177 million allotted up to the beginning of 1958. (The nearest other single item to approach roads is agricultural and veterinary development with some £25 million.)

Even so the mileage of road available is relatively small, as can be seen from the statistics in Table II. Such figures must be approached with caution. They refer to countries with quite different basic resources and backgrounds of historical development. They are, however, sufficient to show that we are only at the beginning of the development of road transport in the overseas territories. What considerations should influence us in guiding this development on the right lines? With the great changes in transport during the past 50 years it is almost presumptuous to assume that we can predict what the needs of the future will be. But experience shows that if present problems are tackled with resolution, the future has the knack to adapt what has been done to its new needs. Thus towns like Salisbury and Bulawayo have already growing road traffic problems, but these would have been incomparably worse had not Cecil Rhodes laid down that the main streets should be wide enough for a South African ox wagon to turn in the width of the road.

The great potential of electric power being developed in Africa at Kariba and Owen Falls, the generation of electricity from atomic power and the ultimate limit on the world's resources of oil all point to a gradual change from the oil engine to the electric motor in inland transport, and this suggests a new lease of life for railways. But the advantages of independent transport units which can travel anywhere over a wide network of roads is such that the development of electricity as the normal propulsion for road vehicles is almost certain.

PRESENT PROBLEMS

These are problems of the future. What are the present problems of roads and road transport in the overseas territories? The main problem is undoubtedly financial—where to find the funds for the necessary capital development. In Great Britain and America the trend is to regard road construction as capital investment, and to determine priorities in road improvement from the return which such investments will bring. Most of the return in Great Britain stems from the increased facility with which traffic moves, from the reduced journey times, from the lower operating costs of vehicles and sometimes from the reduction in road accidents. An indication of some of these benefits was given

to you by Dr. Glanville in his Cantor Lectures in 1950 and 1954, and this approach to road transport was described in detail at the Conference on the Highway Needs of Great Britain in 1957.[4] In this analysis few of the benefits calculated come from the development which the road brings; mainly because it is extremely difficult to predict what such development will be.

Overseas the benefits from new road construction are almost entirely in the form of new development, from the traffic which the new road will generate. Such development is frequently difficult to predict except in general terms, and with our present knowledge it cannot be presented as part of a cost/benefit calculation. This is undoubtedly one of the reasons for difficulties in finding funds for new road work. It leads to the assumption that the traffic must be there first to justify the building of the road. This is a counsel of safety—money will never be spent where it is not obviously needed. It is also a policy which inhibits development, since the construction of new roads generally lags well behind the demands of traffic.

It would be unjust to suggest that Overseas Governments base their road-building policies on such assumptions. Most have extensive long-term plans for road development and some are able to put such plans into execution. In Northern Rhodesia, for instance, 500 miles of Class I roads and 1,700 miles of Class II and Class III roads have been built over the past five years. Kenya has recently announced a £4 million road-building programme with funds provided by loan from the contractor and his associates. Even so, it will help these and other countries as we build up information on the benefits that accrue from the development which follows new road construction.

The benefits to existing traffic from road improvement are by no means negligible, particularly when the improvement involves for the first time the provision of a bituminous surfacing. Although, because of lack of data, such benefits cannot yet be calculated with much precision, there is enough information to show their order of magnitude. Moyer showed in America before the war that the costs of operating a light commercial vehicle were approximately in the ratio 1:1·25:1·4 for travel on bitumen, gravel and earth roads.[5] In Nigeria the Marketing Boards have quoted prices of 6·5d. per ton mile on bitumenized roads, between 6·0 and 7·5d. on gravel roads and from 9·0 to 10·0d. on dry season roads.

Thus the improvement from a dry season road to an all-weather bitumen surfaced road may well reduce the cost of operating vehicles over it by 6d. per vehicle-mile. On a road carrying 100 vehicles per day this is equivalent to a saving of £900 on each mile of road per year.

The cost of up-grading a road, improving the drainage, providing a good base and a bituminous surfacing, normally ranges between £4,000 and £14,000 per mile. The maintenance costs may thereby be increased, probably from about £60 to £90 per mile per year. Thus it can be seen that much of the investment in improving the road can be offset by the reduction in the operating costs of traffic. When the prospects for accelerated development are also considered it

may well emerge that there is a good return from providing roads with bituminous surfacings where traffic is at present much less than 100 vehicles per day.

A curious special case comes from Central Africa. Here, as in many developing territories, some of the main roads have bituminous surfacings only 10–12 ft. wide, with hard gravel shoulders. When passing or overtaking, each vehicle runs with two wheels on the road surface and two wheels on the gravel. A cloud of dust is the normal accompaniment to this manoeuvre, and if the gravel shoulder is made of stony material there is the hazard of flying chippings. This brings a real danger from broken windscreens, and one firm with which I discussed this in the Rhodesias last year had calculated that in their private car fleet one windscreen was broken in every 3,000 miles of travel on such roads. These roads may carry up to 1,000 vehicles a day; taking an average figure as 200 vulnerable vehicles a day, this means that there are 24 windscreens broken per mile of road each year. At an assumed cost of £10 per windscreen (probably low) there is thus a potential gain of some £240 per mile of road each year from eliminating the cause of the breakages.

These somewhat simplified calculations are a reminder that even on roads where the traffic by European standards is very light indeed, the costs of operating traffic over a road system far exceed the costs of building and maintaining the roads. Thus changes in the standards to which the roads are built and maintained are likely to have a much greater effect on the general economy than is represented by their direct cost.

This approach must however be kept in perspective; it is not only bad road conditions that can contribute to the rapid deterioration of motor vehicles. The standards of driving and of vehicle maintenance have a considerable effect. For instance, although many Africans drive with verve and skill they have frequently not yet learned to care for their vehicles adequately; the way they will tackle even major repairs at the roadside often with crude equipment is thoroughly admirable. But the lack of routine maintenance, which led to the breakdown, is frequently a large factor in hastening the final collapse of the vehicle. This is especially so in such territories as Ghana and Nigeria where there are many small African transport businesses which cannot afford to maintain more than rudimentary maintenance services themselves. The annual registration figures in Nigeria show that each year some 20 per cent of vehicles are not re-registered, i.e., that the average working life is about five years. This figure is confirmed by observations made by Hawkins that the average age of commercial vehicles in use in Nigeria is 2·6 years.[6] He ascribes the difference between the average ages in the North (3·3 years) and in the East and the West (1·9 and 2·3 years) partly to the fact that in the North there is a higher proportion of large transport firms which are able to maintain their vehicles well.

EARTH AND GRAVEL ROADS

To return now to the road itself. Only a very small fraction of the roads have bituminous surfaces. Most are of earth or of imported gravel. In the British African Territories only some 3·5 per cent of the public-maintained roads have

bituminous surfaces. In South Africa and Australia only 12 per cent and 8 per cent of the roads are so surfaced. Here in this country it is sometimes not realized that in many parts of the world even the main roads still lack the benefit of a bituminous surfacing. Many present tonight will have experienced the rigours of driving over a corrugated gravel road. Those who have not may find it difficult to imagine that, with the passage of about 100 vehicles, a newly levelled gravel road can develop a surface like a huge wash-board with regular transverse waves, 1½ in. or more deep, some 2 to 3 ft. from crest to crest. The surprising feature is their regularity, wave following wave, identical in form sometimes for many miles. Useless to try to negotiate them at slow speed, the vehicle bucks in a manner excruciating to the occupants and destructive of steering and suspension mechanisms. Experience soon shows that tolerable comfort can be achieved only at fairly high speeds, of over 40 m.p.h.; it seems that for any one vehicle there is an optimum range of speed when the period of rebound corresponds approximately with the time taken to travel from crest to crest.

There have been many theories as to the cause of corrugations, and we have reviewed these in a recent publication.[7] Some suggest that they derive from oscillatory motions in the vehicle, either in the wheels, the suspension or even in engine revolutions. The regularity of the corrugations is evidence against the viability of such theories. Vehicles of many different types and characteristics are found on most roads, yet when the traffic changes, the form of corrugation

FIGURE 1. *Corrugations on Sir Lowrie's Pass, South Africa, showing piling up of loose material on slope facing oncoming traffic*

does not alter a great deal. The controlling factor must lie in the road itself and most likely in the immediate surfacing material. Some surfacings corrugate rapidly; others under similar traffic develop corrugations very slowly if at all. Relton[8] calls attention to other vibrational phenomena such as the wet finger pulled over a window pane, and, nearer still, the small corrugations found in railway lines and tram rails and overhead trolley wires. From this he postulates that the corrugation may be the permanent set remaining after forward deformation of the surface by a moving wheel. This leads to what I believe to be the correct explanation: it has the virtue of simplicity and for this alone it merits acceptance in the absence of any observation which makes a more complicated hypothesis necessary.

1. A wheel moving forward over a loose surface pushes in front of it a bow-wave of material.

2. As this driven heap moves forward it is compressed by the downward and forward forces from the wheel. Under this compression it becomes denser and stronger until it is sufficiently strong to bear the load of the wheel.

3. The wheel then passes over the heap, and immediately begins again to collect material which is pushed forward to be compressed into another heap further ahead.

Support for this suggestion comes from the observation that corrugations move along the road in a direction opposite to traffic. This can be seen only where vehicles travel in one direction—not the normal case. Figure 1 shows corrugations developed under one-way traffic, from right to left, and material scoured from the leeward slope can be seen being piled against the slope facing oncoming traffic.

This suggests that the main critical factor in the formation of corrugations is the packing properties of the gravel forming the road surface and that it is, in theory, possible to select gravels with particles of such shape and distribution of sizes that they do not pack together to form corrugations. Corrugations are a dry season phenomenon, and one way to prevent them is to increase the proportion of silt and clay so that the material is bound together to form a dense, firm surface. But unfortunately the silt and clay is itself a source of instability in the wet season, when it is rapidly worked into impassable mud. Thus the requirements for a surfacing gravel are a compromise, just so much clay to reduce corrugations and potholing in the dry season and not so much that in the wet season the road becomes founderous. Specifications are based on this compromise, and, as might be expected, less clay is called for in wetter, cooler climates.

There is unfortunately another more practical compromise in the large mileage of road to be maintained with very little money. The possibilities of a gravel available near the road may need to be balanced against those of a better gravel which would need to be hauled some miles. Where only hand labour is available the choice is made; the gravel on the spot must be used. Sometimes it is not even gravel, but just the soil from the side of the road. This is road engineering at its crudest. Many minor roads and tracks are still maintained in this way and are likely so to be for many years. Although unfortunately some British territories

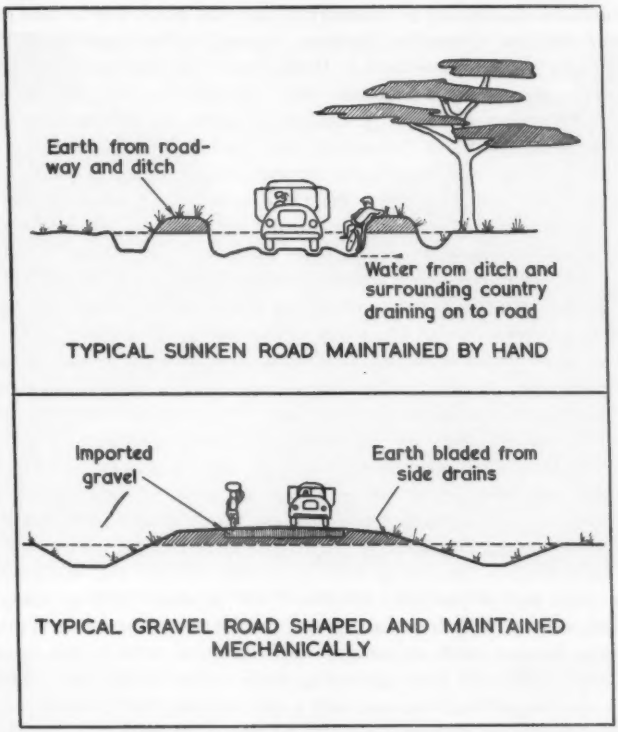

Earth from road-way and ditch
Water from ditch and surrounding country draining on to road
TYPICAL SUNKEN ROAD MAINTAINED BY HAND
Imported gravel
Earth bladed from side drains
TYPICAL GRAVEL ROAD SHAPED AND MAINTAINED MECHANICALLY

FIGURE 2

have been slow to mechanize their road works, there are now only a few where main roads are so crudely maintained.

It is not possible to maintain satisfactorily by hand roads which carry more than about 30 vehicles per day. Generally a sunken cross-section develops (see Figure 2) and in the rainy season the road gives up its normal functions to become a drain for the surrounding countryside. A typical cross-section now normally used, at least on main roads where mechanical plant is available, is shown also in Figure 2. The road bed is above the general level of the ground and is well drained. Perhaps the most important aspect of mechanized maintenance is that it enables the road to be improved as part of normal maintenance so that when the demand comes for a bituminous surfacing there is already a good cross-section and good drainage.

ROADS WITH BITUMINOUS SURFACINGS

The demand for a bituminous surfacing is understandable. In wet countries such as Malaya, and on steep slopes where erosion must be controlled,

a bituminous surfacing may be necessary on any road which is to be used regularly by motor vehicles. Generally, however, a gravel surface provides a tolerable road for light traffic, but as soon as traffic reaches such proportions that there is frequent passing and overtaking, dust, corrugations and potholes become an intolerable nuisance (Figure 3). This is, of course, why bituminous surfacing first began on rural roads in this country in the early years of the present century. Crude gas works tar was poured over the waterbound macadam roads, and from these beginnings have developed the more complicated surfacing techniques used to-day. Undoubtedly we shall eventually see such high-standard surfacings on rural roads overseas. But there are other things to consider first.

One is the width over which the bituminous surfacing is to be applied. Some territories have used strip roads, providing two strips of bituminous surfacing each about 3 ft. wide, rather like a single track railway line. Figure 4 shows one such road in Southern Rhodesia. It is rather a hazardous business passing or overtaking another vehicle, particularly as cars tend to travel at high speeds. Such roads have done good service in the past. They were built when hand labour was readily available; they are not suitable for rapid construction by machine and, as will be readily realized, they are not easy to maintain. In particular the bituminized tracks tend to stand proud of the gravel in the centre and at the sides, and it is a laborious business to make sure that this does not develop into a serious menace to traffic.

The main decision concerning width is usually whether the bituminous mat shall be single-lane or two-lane; whether it will be about 10 ft. or about 20 ft. wide. Both will normally have hard gravel shoulders, and here it is appropriate to mention that new roads overseas are different from roads in this country in one respect. They rarely have upstanding kerbs except in the towns. The cross section is smooth and barrel shaped, with a hard shoulder flush with the carriageway, and sloping away into wide shallow ditches at the sides.

Obviously where traffic is fairly heavy, over 500 vehicles or so a day, then it is necessary to provide at least a two-lane surfacing from the start. On any main road where traffic is likely to increase, a two-lane surfacing is desirable. Where there is any room for doubt the decision is normally made in view of the territory's current economic position. Usually there is a great urge to develop the territory quickly by extending the mileage of bituminous surfaced roads. For the same amount of money more miles of single-lane surfacing can be provided than double-lane, and the argument is that the more miles bring in quicker economic returns and more rapid social development. In general terms such an argument is difficult to resist; but it is worth while examining how many more miles of road can be built if only a single-lane surfacing is provided. With a single-lane surfacing, hard shoulders must be provided for vehicles to pass and overtake. It would be a great mistake to confine the roadway between side ditches which are less than at the least 20 ft. apart. (Regrettably this is still sometimes done.)

Thus in new construction a running surface of two-lane width must be provided whether or not a bituminous surface is applied. The extra cost of providing the two-lane over the one-lane is thus little more than the cost of an extra 10 ft.

FIGURE 3. *A good gravel road in Northern Rhodesia*

FIGURE 4. *Strip road in Southern Rhodesia*

width of surfacing, and this is not likely to be very much in relation to the whole cost of the work. Costs vary a great deal, of course, according to the nature of the terrain. In average undulating bush country, the cost of building a new road, with a single-lane bituminous surfacing, may be of the order of £8,000 to £14,000 per mile. To provide the two-lane surfacing will require a further £700 to £900.

Frequently of course the new road is being provided on the line of an existing track. Even so, earthworks and improved drainage are normally needed and the cost will be in the region of £3,000 to £6,000 per mile. To provide only a single-lane surfacing still does not enable many more miles of road to be built. Except on minor roads where traffic will not be very heavy in the foreseeable future it is questionable if it is normally worth while to provide a bituminous surfacing only 9 ft. to 12 ft. wide.

A bituminous surfacing needs to be supported on a good foundation. In Great Britain this foundation is often of well-packed crushed stone, and the overseas engineer may be excused for looking with envy at his colleague at home who needs only a telephone call to bring in stone by the lorry load, crushed and graded to the sizes he needs. This is one of the lessons the young engineer from this country must learn quickly when he goes overseas. Good crushed stone is difficult, and sometimes impossible, to obtain. It is for instance being carried over 1,000 miles by sea from Hong Kong for roads and buildings in British Borneo. Some territories are more fortunate; in Malaya a chain of quarries has been built up by the Public Works Department during the last few years so that there are few parts of the country more than 50 miles from a quarry. Jamaica and other Caribbean islands have good rock easily won. But other parts of the tropics are covered with thick layers of decomposed rock or of aeolian or water-borne soils, and good rock is hard to find.

Fortunately there are few areas where the soils do not include good road-making gravels. These gravels go under a variety of names but are generally either quartz gravels or lateritic gravels or a mixture of the two. Those with East African connections will recognize the term 'murram'. In West Africa they go under the name 'laterite'. Both terms are used loosely to describe material used in building a road, and neither can be very clearly defined except that they are naturally occurring and are usually red in colour.

A great deal could be written about these materials, but this would be more appropriate for a professional Society. Their value to the road builder is largely determined by the amount of clay they contain. They all generally contain some clay, which helps when they are used for surfacing gravel roads. But once a bituminous surfacing is applied this clay is a disadvantage. The impermeable surfacing prevents water from evaporating; water softens the clay, and if clay is present to excess then it is not long before the road breaks into potholes and the engineer faces a long and expensive programme of repair.

SOIL STABILIZATION

Generally therefore he looks for gravels with as little clay as possible in them. After spreading the gravel over the road, he compacts it with heavy rollers to

make it dense and thus the better able to carry load. But frequently even then it does not make a strong enough base. The engineer is therefore turning increasingly to soil stabilization with some additive such as Portland cement, hydrated lime or bitumen. Soil stabilization is the most important modern development for the road engineer in the tropics. Perhaps it is not correct to call it a modern development; when visiting Hong Kong I found that for centuries the Chinese have been mixing burnt lime with decomposed granite to make a material, 'chunan', used for lining irrigation ditches and as a plaster. Lime has been used for many years by farmers to improve the texture of clayey soils; and in places like Trinidad, natural asphalts have been used to pave roads since roads were first needed.

The newness is in the application to make it possible to use soils for road-building which would otherwise be quite unsuitable. Many of the tropical gravels are almost, but not quite, good enough and only small proportions of cement or lime are needed. In Northern Rhodesia, for instance, some 300 miles of road have been built during the past six years using up to 6 per cent of hydrated lime. There has in fact been as much if not more soil stabilization done in Northern Rhodesia than in the United Kingdom. The State Engineer of Brunei has in the past four years changed the method of road construction, from using crushed stone to soil-cement, and has thereby brought down his costs of construction by some 30 per cent.

Soil stabilization is now being employed in almost all the overseas territories (Figures 5, 6 and 7), and one of our tasks as a research organization has been to assess the soils available in different territories, particularly to determine their suitability for soil stabilization. We found, for instance, that the sandy soils available near Lungi, Sierra Leone, were most suitable stabilized with bitumen, and this is what was done in constructing the airfield there. In Kenya much of the new road building programme will be over 'red coffee soil', a special red tropical clay, and in areas where it is difficult to obtain good roadstone or even good natural gravels. Here we have helped the Kenya Ministry of Works in establishing that good road bases can be made by stabilizing the red clay with hydrated lime.

PAVEMENT DESIGN

Whether the road base be natural gravel, stabilized soil or crushed rock, there is also the decision as to how thick it must be. This depends on the nature and condition of the soil over which the road is built. If it is a strong soil in a dry situation then no added base may be needed at all; if it is a weak soil such as black clay, then the road structure may have to be 24 in. thick or more, to reduce the traffic stresses on the soil below to a tolerable figure. Here the moisture conditions in the soil are all-important. In Figure 8 are shown the thicknesses of construction needed over two common tropical soils, lateritic gravel and black cotton soil. It will be seen that differences in moisture conditions have an enormous effect on the thickness of construction required. The range of moisture conditions shown in the diagram are just about those which may occur in different situations in the field. It will be readily appreciated how important it is therefore

FIGURE 5. *Main road in the oil concession, Brunei: built of sand stabilized with bitumen, with a bitumen macadam surfacing*

FIGURE 6. *Heavy loads on the Lusaka-Kafue road, Northern Rhodesia. This road is built of lime-stabilized gravel*

for the engineer to know how wet the soil under the road or airfield will become. This is a problem of great complexity. In Great Britain, where the water table does not vary greatly with the seasons, it can be resolved as a problem of statics[9]. No such analysis is possible in the tropics where, with well defined wet and dry seasons, there is frequently no regular water table at all.

The more conservative engineers base their designs on the assumption that the soil under the road will become saturated. This is safe if sometimes heavily extravagant design. Others, being hard pressed to spread money for roads as thinly as possible, assume that the soil will remain very dry, and they may thereby be grossly underdesigning. More exact knowledge of the moisture conditions which occur in practice will make it possible to design roads and airfield runways with much greater precision.

We already know a great deal from analysing data collected by the Air Ministry on soil moisture conditions under airfields in different parts of the world[10]. On roads the problem is further complicated by the greater importance of water penetrating under the sealed surface from the edges, and for the last nine months we have had a research team in Kenya making regular measurements under roads in the vicinity of Nairobi. This investigation is financed partly from our own funds and partly by the Kenya Ministry of Works and Road Authority. It furnishes a pattern for co-operation in field investigations which we are developing also with other territories.

FIGURE 7. *Cement-stabilized road under construction in Ghana, showing cement being mixed with the soil*

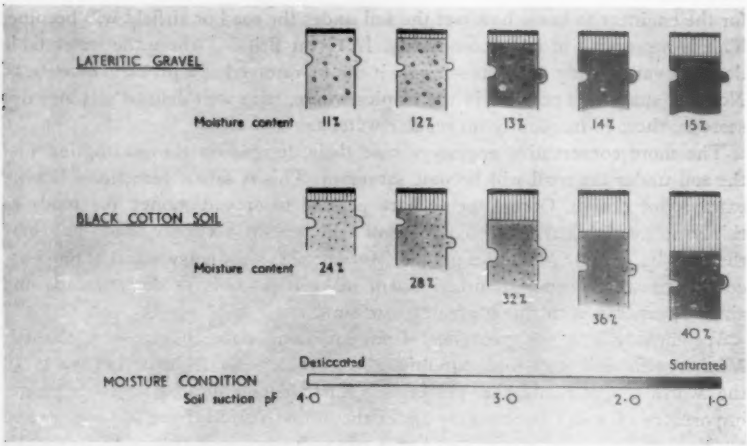


FIGURE 8. *Soil type and moisture affect the road thickness needed*

SITE SURVEYS AND DESIGN

You will readily realize that when a civil engineering project overseas is first conceived, generally very little is known about the site. The job cannot be well done without a thorough survey before work begins.

Unfortunately even mature politicians will begin to shout loudly if there are not immediate signs of progress once a decision is made to proceed. Here aerial survey is proving a valuable tool not only to give a rapid and accurate map of ground contours, but also to indicate the likely engineering properties of the soil on the site, the ground water conditions and the location of nearby deposits of rock and gravel which can be used in the project.

Even so it is often difficult for Public Works Departments and Consulting Engineers to muster the resources so that project reports and, later, designs and specifications can be rapidly produced. In a recent lecture to the Society Mr. Tritton, the President of the International Federation of Consulting Engineers, referred to increasing competition which British consultants are facing in the international field. There is much to be said for his suggestion that consultants should combine together in an organization so that they are better able to undertake big projects overseas. In other countries such organizations have been set up with Government support; one minor advantage would be that such an organization could help to make sure that money given or loaned from this country for civil engineering works overseas is wisely spent.

RESEARCH IN GREAT BRITAIN ON OVERSEAS ROAD PROBLEMS

These are some of the problems encountered in road-building overseas. There are many others; bridge design and construction, the special problems of controlling erosion in the vicinity of roads, the growing social problem of road

accidents, traffic and parking problems in the rapidly growing towns and cities. Important though these are, bare mention must here suffice and I should like to conclude with a brief note on the research organization which is being built up to help in solving these problems.

It forms part of the Department of Scientific and Industrial Research's Road Research Laboratory. The Laboratory has always been interested in roads overseas, an interest stimulated by the lively contacts which have always been maintained with Public Works Departments and others concerned with roads in the Overseas Territories. This interest became more active in 1948 with the appointment of a Colonial Liaison Officer, and shortly afterwards a grant from Colonial Development and Welfare Funds to cover his activities. He spent much of his time travelling in different overseas territories, advising from our own research experience and from the fund of knowledge he himself built up as he moved around. But it soon became evident that there were special problems where organized research was needed to find solutions. Many of these problems came up repeatedly at the Round Table Conferences on Colonial Highway Problems which were held every two years in London under the auspices of the Colonial Office. It was largely as a result of deliberations at these Conferences that a section of the Road Research Laboratory was formed three years ago especially to consider the road problems of the overseas territories. Originally financed entirely from Colonial Development and Welfare Funds, we now also receive regular contributions from almost all Colonial Governments.

Research is profitless unless the conditions exist so that the results may be usefully applied. The Colonial engineer works under conditions of great stress. He generally has much greater responsibilities than his counterpart in the United Kingdom. He has many more small ones too; for instance, it is not at all uncommon to find the engineer himself calculating and distributing the wages to the men on the works he controls. It would be small wonder if he could find neither time nor inclination to keep abreast of modern developments. But repeatedly we find in the short training courses run by the Laboratory that it is the engineers from overseas who lead in technical discussions. Some forty overseas engineers attend these courses each year. Although in the field they sometimes lack the resources to apply new knowledge, they lack nothing in enthusiasm. All the larger territories now have their own testing laboratories where they can assess the potentialities of local roadmaking materials, and we have been operating a training scheme whereby engineers who are going to work in these laboratories come to the Road Research Laboratory for periods of six months or so to work alongside our men. When, in August last year, I attended the first pan-African Conference of Road Specialists in Lourenço Marques under the auspices of the Scientific Council for Africa South of the Sahara, I found that of twelve delegates from Commonwealth and Colonial Territories in Africa, six were old boys of the Road Research Laboratory. This I think is an example of a bond between the United Kingdom and Commonwealth Territories which can grow to great usefulness, a bond which nevertheless needs conscious effort to be sustained.

From this comes the last and one of the most important issues discussed in this paper. When what is now the Tropical Section of the Road Research Laboratory was formed three years ago, some people said that it was too late, that with the rapid march of many of the Colonial Territories towards independence, the new Section would have a smaller and smaller sphere of influence until in a few years there would be too few territories to make continuation worth while. This is a very limited view. British civil engineers have a long tradition of activity abroad and they bring their technical problems to us from the Commonwealth and from other countries. The newly independent territories, facing new political difficulties, are still beset by the same technical problems as before and they are eager to continue in co-operation within the Commonwealth in the attack on these problems. Here the sphere widens to include the many other research organizations, in agriculture, in medicine, in sociology and economics, and other fields. All these are considering how the needs of the newly emergent territories can be met, and behind it all is the thought of building up greater co-operation in the Commonwealth in research on common problems. Here there are two visions for the future. One is of a possible Central Commonwealth Research Organization charged mainly with maintaining liaison between workers in different parts of the Commonwealth and possibly administering research funds to which all would contribute. This would not do. It would no doubt circulate large quantities of paper which few of us would have time to read. It would employ trained men who could be used more effectively and who would certainly be far happier on primary production in scientific work. The other vision is more nebulous but far more desirable. It certainly contains within it centralized research units for groups of territories which individually are not big enough to maintain their own. But the main principle is one of free and frequent personal contact between scientific workers who are actively engaged on research in allied fields in the different Commonwealth countries. This will bring a greater awareness of common problems and fuller consciousness of the value of the work. More tangible outcomes will be agreements, if only at the informal level, to divide the field of work; and mobility so that men with particular expertise can go where conditions are most favourable for their study, and where they are most useful.

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DISCUSSION

MR. PONSONBY: Could Dr. Millard tell us roughly the difference in cost between constructing (i) strip road with bitumen surface (as they have had in Southern Rhodesia), (ii) an ordinary road with bitumen surface for single line traffic, and (iii) an ordinary road with bitumen surface for double line traffic? I think he said that it does not really cost so very much more to have a double instead of a single line. Is it one-quarter more or one-third more?

THE LECTURER: It is rather difficult to give a general answer because costs vary enormously according to the nature of the terrain. In typical open bush country the total cost of building the road may vary between say £4,000 and £15,000 per mile. The cost of the bitumen surface is probably of the order of £1,000 to £2,500, dependent on the width treated and the number of applications involved. It is thus often not a large proportion of the cost. It becomes more if you have to make a stronger base.

THE CHAIRMAN: I should like to make one comment at this stage, arising out of this question of the relative costs and benefits which derive from strips single-laid and double-laid. Quite apart from capital costs, I think that a most important factor is the cost of maintenance. There is a big difference, in the cost of maintenance, as between a gravel road and a bitumen road. A gravel road may cost anything from £60 to £100 per mile per annum to maintain; a bitumen road of two lanes may cost up to £400 per mile per annum, and its expense is directly related to the square footage of the bitumen carpet. Therefore it does seem to me that in terms of annual maintenance costs, which are a very real problem in the territories overseas, a two-lane road would cost very much more than a single-lane road.

THE LECTURER: Sir Reginald has put his finger on a very important point there, but I think one wants to remember the traffic intensity which we are considering. We are thinking of roads carrying perhaps 200 or 300 vehicles a day. If a narrow bitumen surface is used, one has still the maintenance problem of the gravel shoulders, coupled with the maintenance problem of the bitumen. Moreover, it is not easy to maintain the gravel shoulders mechanically; a blade-grader cannot be operated across the road. It is true that gravel road costs are not so high as those of a bitumen surface road—until one gets to 200 or 300 vehicles a day, when the costs go up rapidly. I have heard cases quoted of gravel roads which cost more to keep going than a properly constructed bitumen road. For fairly heavily trafficked gravel roads or fairly lightly trafficked bitumen roads, costs of maintenance may be in the region of £90 to £150 a year.

MR. J. H. P. HAWTREY: Arising from what Dr. Millard has just said, I remember, during the reoccupation of Burma in the war, that the main roads built and maintained before the war by the P.W.D. were submitted to intense military traffic. The tarred strip which only allowed one line of traffic was carrying two solid streams of traffic. When the two met, every vehicle had to get off that central strip, and the edges were being worn rapidly away. I remember one senior military engineer officer saying that he thought it would have been much cheaper for the P.W.D. in the first place to build a double lane of tarred strip rather than a single one; and that I think has been even more strongly demonstrated when there are two narrow strips, such as Dr. Millard showed, and you have four shoulders to maintain.

MR. CURZON HARPER (Borough Engineer, Barking): I assume that the disadvantage of the single track is felt when you come to overtake or cross? Would there be any advantage in what in the old tram-way days we used to call turnouts—in other

words, special localities actually made for passing by turning out at predetermined intervals?

THE LECTURER: They are used under certain conditions, but when one considers that on these roads one quite often attains 50–55 miles an hour, they are not really a practical proposition in open country. Another factor is that gravels for making hard shoulders are usually readily available, and there is no great difficulty in providing the continuous gravel strips on either side.

MR. HARPER: If that is so, Sir, if you don't worry much whether the gravel is greatly inferior to the bitumen, why worry about doubling it?

THE LECTURER: The point is, I think, that it is generally best to have a running surface which is either entirely gravel or entirely bituminized.

MR. J. M. FENTON, M.B.E.: I should like to ask Dr. Millard what determines the selection of hydrated lime as against Portland cement? Is it availability, or cost, or worthiness? Could Dr. Millard say something about the virtues of hydrated lime and cement in respect of cost and worthiness?

THE LECTURER: Generally, Sir, the answer there is availability. There are differences. Portland cement will set more rapidly. Under certain circumstances that is an advantage; under other circumstances it may be an advantage to use hydrated lime, which sets less quickly and therefore gives you more flexibility with your compaction. With some soils, the clay soils particularly, hydrated lime is probably slightly better than cement; with other soils, where there is not very much clay, cement may be better than hydrated lime. With non-cohesive sands it may well be that bitumen is in the market too. Primarily the answer as between cement and lime is one of cost, but there are technical considerations as well with certain soils.

MR. G. VIVIAN DAVIES: I should like to ask our speaker what type of drains, if any, is used on these roads?

THE LECTURER: Almost invariably open drains, which are surface water drains. I showed the typical road cross-section with the drains cut at the side, which serve two purposes; one to take away the surface water from the road and the other to interrupt overland flow. That is associated with culverts at intervals, according to the type of country, to get the water from one side to the other. I sometimes think, though, that there are some soils and some circumstances in which if you could dispense with the drain altogether and just lift the road it would probably be better than ever—but it is usually a question of balancing cut and fill sideways—taking the soil from the side to build up the road.

MR. R. S. COLQUHOUN: I noticed from Dr. Millard's pictures that most of his examples came from the dry or semi-arid areas. I wonder, has he any advice to give to engineers who are working in monsoon countries, or in places where the rainfall is 200 inches or more per annum? How do you make a low cost road by soil stabilization under those circumstances?

THE LECTURER: I did mention successful soil stabilization in Brunei, where the rainfall is of the order of 200 inches a year. One has to adapt one's technique. First of all, one wants to look to see whether the traditional materials are there. Is there good road stone? In Malaya there is. Next, is there easily stabilizable material? If there is, will it be cheaper to use stabilized soil than crushed stone? If that turns out to be so, how to do it—and it might well be that in a wet climate it is best to mix the stabilizer into the gravel at the pit where the gravel is dug, rather than do the mixing after the gravel is spread on the road. The situation is then more under control

than when mixing on the site, and the work is no more affected by rain than it would be if other forms of construction were used.

MR. EDWARD M. GOSSCHALK: I was interested in Dr. Millard's explanation of corrugation, but I find difficulty in reconciling it with the formation of corrugations on very dry dusty roads (and they certainly do form on such roads) where most of the dust seems to be thrown up behind the vehicle's wheels. I wonder if Dr. Millard has any further comment on that?

THE LECTURER: This is something about which we could go on talking all night! One alternative explanation offered by some people is that corrugations are formed by dust and other loose material projected backwards by traffic. But there is unfortunately not time to go into this in detail now. [See also Appendix below.]

A vote of thanks to the Lecturer was carried with acclamation and, another having been accorded to the Chairman upon the proposal of Sir John Woodhead, the meeting then ended.

APPENDIX

Dr. Millard writes:

'Because, towards the end of the discussion, time was pressing hard, I was not able to give Mr. Gosschalk a very complete answer.

Undoubtedly the chief evidence of the passage of a motor vehicle over a gravel road in the dry season is the cloud of dust which follows it. This dust is, of course, formed of very fine particles which, when they settle, do so at random over the road surface and the surrounding countryside. The dust is generated mainly by the air disturbances caused by the passage of the vehicle. Some people have suggested that these air disturbances also contribute towards the formation of corrugations. I incline more to the suggestion that they are formed of material pushed forward and compacted by the wheels of vehicles, because it is simple and, so far, can explain any observations which have been made on the way in which corrugations develop.'

FROM JUNGLE TO ZOO

A Dr. Mann Juvenile Lecture

by

GEORGE CANSDALE, B.A., B.Sc., F.L.S.

Wednesday, 7th January, 1959

When I arrived at Takoradi in 1934 the Gold Coast was a very different place from present-day Ghana. I had trained as a Forest Officer and was just taking up my duties in the Colonial Service, where much of my early work took me out in the dense forests surveying and marking out reserves on the hills and main watersheds; I was sometimes away from my headquarters for eight or ten weeks at a time and up to 100 miles from my nearest fellow countrymen.

Through school and student days I had been interested in several branches of Natural History, but especially in birds. When I found myself in the jungle, however, the birds were so remote—perhaps 150 feet up in the tree tops—that they were almost impossible even to see. Many of them belonged to families of which I had hardly heard and there were no books then to identify them, so I became rather discouraged. Soon I switched over to the smaller mammals and, later, to the reptiles, partly because these were easier to come on terms with and prepare as museum specimens, and partly because nobody else seemed to be studying them just then. The larger mammals were fairly well known, but the little things—the bats and the shrews, the bush babies and the mice—had hardly been thought worthy of attention.

The first thing was to find out their names. I encouraged the hunters and farmers to bring in everything that they caught or killed. Everything dead was examined carefully, measured, weighed, described and preserved; and then sent to the British Museum for identification. Before I left in 1948 we had added nearly a dozen species to the Ghana list and found five forms that were quite new—two fruit-eating bats, a strikingly spotted black and white insect-eating bat, a mouse-sized pigmy flying squirrel, and a most elegant swamp rat.

We begged the hunters to bring in their specimens alive and in perfect condition, and then we tried to keep them alive, learning their noises, hoping that they would feed well, taking their photographs and finding out all we could about them. Other things took our attention during the war, but as it came to its end, I managed to find ways of sending home a few specimens to the depleted zoos in Britain. As soon as regular air transport was established, taking first 48 and then only 24 hours, I used to send monthly shipments of reptiles and small mammals. These went mostly to London, but some also to Chester, Edinburgh, Dublin and Washington zoos. As each leave drew near I got together a mass of larger things that could hardly be sent by air, and once the London zoo sent

out a head keeper to take back a big collection, including many birds that had never been exhibited before. Had you visited my bungalow you would have found anything up to 200 head of perhaps more than 100 different kinds, in boxes, cages and enclosures of all sorts, around, under and even inside my bungalow.

It was nearly eleven years ago that I returned home to become Superintendent of the London zoo, and at that time colour film was only just becoming available, so that most of my numerous pictures were in black and white. In 1956 and again in 1957 I had the privilege of revisiting Ashanti to advise the local authorities about the building of a zoo in Kumasi, a zoo that was opened formally by the Prime Minister, Dr. Kwame Nkrumah, at the end of 1958. I took the opportunity of exposing a good deal of colour film, and it is some of these pictures that you will see now.

First we must take a quick trip through the country. A fringe of palm trees runs along most of the coast and inside it is a strip of varying width of open grassland. My recent visits were made during the rainy season, so everywhere was green and clouds frequently filled the sky completely. The forest is hard to show adequately in colour, for beneath the untouched jungle there is no light for photography, but these pictures, taken from the roadside, give you some idea of what it was once like. Water is everywhere during the rains, and the larger rivers, especially the Volta, which is by far Ghana's longest river, show all too clearly the results of clearing the hill forest in order to make farms. The heavy rains at once strip off the fertile top soil and the rivers go down to the sea brown and silt-laden. Many of the staple crops are those you will know only as names in travelogues; the plantains—giant cooking bananas—are perhaps the most important, with cocoyams and cassava or mandioc, from which starch and tapioca are made. Rice is grown in the swamps, and Indian corn, or maize, is the main crop in some areas.

As one travels north the annual rainfall gradually decreases and the two rainy seasons of the forest zone merge into one heavy rainy season, thus leaving a long dry season; one result of this is that the closed forest gives way to grassland with varying numbers of scattered low trees. Still travelling north, one finds the country becoming progressively drier and the climate more extreme; finally, we reach the northern frontier, some 500 miles from the coast, where the crops are almost entirely millet and guinea corn.

The high forest is utterly destroyed by the farming operations: the pressure on the land, and the demand for more and more cocoa farms, mean that the land can no longer have the ten-year minimum period of fallow that it really needs, after the initial three years of food farming, before being cleared and farmed again. Each year, therefore, more and more forest is destroyed as the land is cleared for farming. Some of the animals are driven out, but for many of them, including several kinds of squirrels, many mice and rats, the porcupines, the bats and various others, the farmlands and temporarily deserted farms are far richer feeding grounds and their numbers leap up. The untouched forest hardly provides a living for them and they are essentially animals of the secondary

forest. As a Forest Officer, I was particularly interested in the changes which took place in the vegetation and also in the resultant changes of animal population, and so we concentrated particularly on these areas.

The open areas of the north are less affected by farming, for they are mostly grass-covered and burnt every year, but the trees are gradually cut down and new ones have little chance of growing up, so the land tends to become more and more open. As a result, most of the antelopes, once fairly common in some parts, have now been driven back into the sparsely inhabited areas.

Having shown you the country and the conditions in which they live, I now want to show you just a few of the hundreds of kinds of animals that passed through my hands. On my recent visits I had no time or opportunity to do any collecting, so I had to be content to photograph those that my friends were keeping, but many of these were old friends.

The chimpanzee is by far the rarest of the primates and it is found in a rather narrow belt down the west of the country, alongside the Ivory Coast frontier. It is sad to report that almost all the young chimpanzees that one sees in captivity have been caught by killing one or both of the parents—for use as food or for their skins. Most hunters have little idea of feeding these babies and think it a waste to give them milk, so we tried to take them over as soon as possible and put them on to proper rations.

The Lecturer introducing members of his audience to Polly, the bush baby from Tanganyika

The white-thighed colobus is the most striking of the true monkeys, and also the biggest, except perhaps for an old male baboon. It lives mostly in the tree tops and is a leaf-eater, and for this reason not at all easy to keep in a zoo. The strange potto, on the other hand, is a strictly noctural lemur that clambers about slowly on the lower trees and shrubs, being greatly feared by the African farmers for its powerful grip. It makes a rather dull zoo exhibit but does well enough on a mixture of fruit and meat.

The typical forest antelopes are known as duikers, from an Afrikaans word meaning 'diver', and they do indeed duck and dive through the undergrowth and make pursuit impossible. The Maxwell's or grey duiker is perhaps the commonest of these forest dwarf antelopes, standing some 24 inches from the shoulder. The forest is also the home of the royal antelope, the world's smallest antelope, with a body size little greater than that of a wild rabbit and weighing under 5 lb.

The strangest mammals in the whole of Africa are the scaly anteaters: covered almost entirely with horny overlapping scales and with prehensile tails twice the length of their head and body, they are toothless throughout their lives and live by lapping up ants with their long sticky tongues. The tragedy was that they would never accept confinement, and after keeping them under observation for a few days we used to release them.

Many of our birds arrived as fledglings found by farmers or school children and we had to rear them. I was very fond of the owls, especially Fraser's eagle owl and the Abyssinian eagle owl; the latter had a strange double hoot, the second note deep and sepulchral and guaranteed to make anyone jump.

Ghana abounds in lizards, with between thirty and forty kinds, ranging from minute worm-lizards to the 6 foot Nile monitor, and including such colourful types as the chameleon and the orange-flanked skink. Snakes were less often seen, but even more varied, with over 80 species: some were deadly poisonous, like the Gaboon and the rhinoceros vipers and the spitting cobra, but many were quite harmless, like the royal python which had come back from Ghana with me.

At the end of the meeting the tame royal python, Percy, was handed round and then Polly, a six-year-old bush baby from Tanganyika, delighted most visitors (and scared a tiny minority) by leaping from shoulder to shoulder with great energy and obvious enjoyment.

GENERAL NOTES

RETIREMENT OF SIR GORDON RUSSELL

It is announced that Sir Gordon Russell, C.B.E., M.C., R.D.I., F.S.I.A., has decided to retire from the Directorship of the Council of Industrial Design on 31st December, 1959, when he will be 67 years of age. This decision has been accepted by the Council with reluctance and with the keenest appreciation of the contribution which Sir Gordon has made to its work throughout its entire life. He was an original Member of the Council when it was instituted in 1944, and has been its Director since 1947.

Mr. Paul Reilly, who joined the staff of the Council of Industrial Design in 1948, and became Deputy Director in 1954, has been appointed to succeed Sir Gordon Russell, as from 1st January, 1960.

As recorded on page 231 of the present *Journal*, Mr. Reilly was elected a Member of the Council of this Society on 9th February. It is appropriate to recall here that Sir Gordon Russell has himself served twice in that capacity: from 1947–9, when he was Master of the Faculty of R.D.I., and again from 1951–5.

GOLDEN JUBILEE OF THE ILLUMINATING ENGINEERING SOCIETY

This Society sent a message of congratulation to the Illuminating Engineering Society on the occasion of its Golden Jubilee, which was celebrated on 9th February.

The systems of lighting in use fifty years ago were comprehensively described and illustrated (with apparatus lent by many manufacturers of the day) by Leon Gaster in a series of four Cantor Lectures delivered to the Royal Society of Arts in February and March, 1909 (*Journal*, Vol. LVII). At the end of his survey, Gaster spoke of a prevailing need for 'the expert illuminating engineer'—'a man who shall be independent of any connection with any particular system of lighting, but who will take an impartial and unprejudiced view of them all . . . [he] must be . . . not only willing and able to appreciate the economical and technical aspects of problems, but also in touch with the physiological and aesthetic aspects'. It was to bring about the gradual development of such engineers, and to provide 'a common platform for free discussion by any one interested in the subject', that the Illuminating Engineering Society, of which Gaster became the first Secretary, was formed. The first of these objects has long since been achieved, and the great advances which have taken place in the whole science and art of lighting during this half century are largely attributable to the stimulus provided by the Society.

TRAVEL GRANTS IN THE FIELD OF THE ARTS

The English-Speaking Union this year again announces the offer of four travel grants to the United States. Applications for them may be made by men and women of British nationality, aged between 30 and 50, who are experienced in a branch of the arts such as painting, sculpture, music, architecture or design. Museum curators and art historians are also eligible.

Each grant will cover the cost of travel to and from the United States and travel within that country. There will also be a subsistence allowance for each day spent in the United States, up to a maximum of 56 days, which is the recommended length of the visit. The grant may be taken up at any time from September to October, 1959, but it must be completed by 1st July, 1960.

Application forms and full particulars may be obtained from The Secretary, The English-Speaking Union, 37 Charles Street, London, W.1.

OBITUARY

We record with regret the deaths of four Fellows of the Society:

SIR CLAUDE GIBB

Sir Claude Gibb, K.B.E., D.Sc., M.I.Mech.E., F.R.S., who died suddenly in New Jersey on 15th January, aged 60, had a distinguished career as an engineer, and played a considerable part in the post-war development of nuclear power in Great Britain.

He was born in Australia and educated at the Australian School of Mines and Adelaide University. After service in the Australian Flying Corps in the latter part of the First World War, and a period spent acquiring practical and academic

experience of his profession, he came to England in 1923 to join C. A. Parsons & Co. Ltd. He began as a fitter, but Sir Charles Parsons quickly recognized an engineer of his own quality and determination, and Gibb earned rapid promotion. By 1929 he was chief engineer and a director of the firm; in 1937 he became general manager, and, six years later, joint managing director.

The second phase of Gibb's career brought opportunities to work first for the survival and then for the prosperity of this country. During the Second World War, in a series of key appointments, he brought about a remarkable increase in the volume and efficiency of armaments production. For his services in this vital sphere he was knighted in 1945. In the same year he resumed his business responsibilities.

Gibb's awareness of national needs did not diminish with the advent of peace. Recognizing the importance of developments in the sources of power, he was soon actively associated with them. Under his chairmanship, C. A. Parsons & Co. Ltd. prospered and expanded, until last year the firm (which had previously been concerned with the building of Calder Hall) was awarded a contract to supply the largest turbo-generator yet projected, for the Thorpe Marsh Power Station. In 1958 also, Gibb himself became first Chairman of the Nuclear Power Plant Company, which is responsible for the construction of the commercial nuclear power station at Bradwell, Essex.

Gibb was elected a Fellow of the Royal Society in 1946, and in 1956 he was made K.B.E. For a number of years a Vice-President of the Institute of Mechanical Engineers, he twice received its Thomas Hawksley Gold Medal. Just before his death he was awarded the Institute's 1959 James Watt International Medal.

Jointly with Dr. A. T. Bowden, Sir Claude read a paper to this Society on 'The Gas Turbine: with special reference to industrial applications' in 1947 (*Journal*, Vol. XCV, p. 265). He became a Fellow in 1948.

MISS VIOLET MARKHAM

Miss Violet Markham, C.H., who died in Kent on 2nd February, aged 86, possessed remarkable administrative and intellectual ability which, together with her wisdom and charity, won her a unique place in public esteem.

She was born to affluence and leisure, her father, Charles Markham, being a leading industrialist in Chesterfield. Her mother, a cultivated woman of high ideals, was the daughter of Sir Joseph Paxton, architect of the Crystal Palace. The Markham family's position and interests brought Violet into touch with politics and municipal affairs at an early age, but her first opportunity for rendering service of more than local importance came in 1914, when she joined the executive committee of the National Relief (Prince of Wales's) Fund. In the same year began her long and fruitful association with the Central Committee of Women's Training and Employment—a body of which she was later a most effective chairman. In 1917 she became Deputy Director of the Women's Section of the National Service Department and was one of the first to be appointed a Companion of Honour. There followed an unsuccessful attempt to enter Parliament as an Independent Liberal in the General Election of 1918.

The record of Miss Markham's activities in the public service during the period between the wars is an impressive testimony to the range and depth of her interests, which extended from Chesterfield—of which she was for many years a town councillor, and mayor in 1927—to the Dominions, particularly Canada and South Africa. It was in work for the alleviation of poverty and hardship, however, that she was most prodigal with her gifts of mind and heart. Admirably equipped to discharge the

duties of Deputy Chairman of the National Assistance Board, she found in that post (to which she was appointed in 1937) the most exacting task of her career. During the last war she nevertheless also found the time and energy to organize a canteen for the destitute in South London, to take the Chair of the governmental committee which investigated allegations of immorality in the women's services, and (with Miss Florence Hancock) to prepare a report on the post-war organization of domestic service, which attracted much favourable attention for its thoroughness and clarity of view.

Violet Markham's ability as a writer, indeed, was considerable. Her published works include not only penetrating appraisals of social and political problems, but volumes of memoirs and biography. The most notable of the latter, *Paxton and the Bachelor Duke* (the sixth Duke of Devonshire), appeared in 1935. There was a special place in Miss Markham's affections for her grandfather, whose achievements as architect of the Great Exhibition this Society also gratefully remembers. She was elected a Fellow of the Society in 1946, and in 1950 commemorated this mutual interest by a delightful paper on 'Sir Joseph Paxton and his Buildings' (*Journal*, Vol. XCIX, p. 67). Later in the same year she endowed a Trust of £1,000 in Paxton's memory, to be administered by the Royal Society of Arts, the income therefrom to be used chiefly 'for the encouragement of horticulture and of exhibition design'.

SIR FREDERICK TIDBURY-BEER

Sir Frederick Tidbury-Beer, a former Lieutenant, Alderman and Sheriff of the City of London, died at Godalming on 7th February, aged 67.

He began his business life when he was 13, as an office boy. In 1911 he entered the Stock Exchange, of which he became a Member in 1922. During the First World War he was attached to the French Army Medical Service, and when hostilities ceased was for some time a technical officer in the Royal Air Force. His first direct experience of municipal affairs was acquired on the Urban District Council of Welwyn Garden City, but in the 1930s the welfare and traditional dignities of the City of London came to absorb an increasing proportion of his time and interest. From 1940–54 he served on the Court of Common Council, and as a Member (and quondam Chairman) of its Improvements and Town Planning Committee became closely concerned with the problems of post-war reconstruction; in particular with the rebuilding of the devastated area around St. Paul's Cathedral. During this period he was also a Member of the Advisory Committee on London Regional Planning and Chairman of the City of London Licensing Planning Committee. He received a knighthood for these services in 1947.

Apart from his administrative responsibilities, Sir Frederick was prominently associated with many other aspects of London life and its great foundations—churches, livery companies, hospitals and schools. A lifelong student of the history and topography of the City, he derived particular satisfaction from his Vice-Presidency of the London and Middlesex Archæological Society.

Sir Frederick was elected a Fellow of this Society in 1937.

SIR FRANK BROWN

On going to press we are deeply sorry to learn that Sir Frank Brown, C.I.E., the noted authority and writer on Indian affairs, has died at his home in London at the age of 90. An obituary notice will be published in the next issue of the *Journal*.

NOTES ON BOOKS

THE BLACK FENS. *By A. K. Astbury. Cambridge, The Golden Head Press,* 1958. 42*s. net.*

The topography of our land must be known to thousands of tourists by private motor car, by motor coach, by cycle, and less recently, by the enthusiastic pedestrian. One area has been shunned by most if not all of these: only the residents and their suppliers, and the people who carry their produce away, the drainage engineers and so on, know the Black Fens, which are at once their habitat, the source of their livelihood, and the part of England least known to the rest of the country. The casual observation of the traveller by train through the area only makes him the more anxious to get through this desolate scene. It is flat, black and unsightly to the eye of the outsider.

Yet it is one of the most productive farm areas in the country. But the rich, black vegetable soil is sinking and wasting away, and there is every prospect that much of it will have vanished within a century, leaving behind it only a heavy, intractable clay, difficult and costly to work, productive only when supplied with heavy applications of expensive manures: in other places the subsoil will be plain desert not to be made fruitful by any process yet known.

The fen dweller has always had many problems, not the least of which was that of drainage. The story of his efforts is a lengthy one, and is not yet fully known. Mr. Astbury has traced the course of the many numerous ancient man-made waterways across the Fens indefatigably, and offers many theories of the purposes for which they were dug by the Romans and perhaps by an even older people.

Besides the water saturation of the soil and flooding which was and is recurrent, the people who lived in the Black Fens had many other difficulties. Since the soil was peat, except in places where tidal waters had deposited a firmer silt, they had to be careful where they sited their houses. On the peat they were liable to subsidence: on the silt they stood firmly. The same is, of course, true of roads and railways. Some of the concrete roads laid so hastily during the wartime ploughing-up campaign have already disintegrated.

The main drainage works were made in the seventeenth century, and the more these peat lands are drained and cultivated, the more they shrink. In modern times, too, the dry soil has often been blown away in dust storms before the high winds from the east, thus adding another problem to which there seems to be no solution, except the final result of man's activity here, the complete disappearance of the peat.

Ever since the beginning of man's occupation his work here has been tending towards this end. By physical development the area now lies in a saucer between the highlands which bound it and the sea. Water from the hills and the tides both threaten it. Man has therefore always driven cuts, leams, dykes and artificial rivers through the Fens to carry the water away, or prevent it flowing upon the land. Mr. Astbury must have traversed the whole countryside to find the remaining traces of many of these vanished works, and his book is illustrated with air photographs that are full of interest. The way of life of the Fenman has been often discussed in historical works, but rarely in a detailed topographical work such as this—which describes what may be the last unknown part of England, and records its current condition. It is perhaps curious that Mr. Astbury makes very extensive acknowledgement to various people living or recently living, but supplies no bibliography of sources.

G. E. FUSSELL

DECORATIVE ART 1958–9. *London, The Studio,* 1958. 35*s net*

This hardiest of annuals seems to get better as the years go by. The reason may be simply that design is everywhere improving and thus the editors' job becomes easier.

Or it may be that the editors themselves are becoming stricter in their selections. At all events the present issue, with one or two startling exceptions, offers a reasonably coherent picture of the way things are going in many countries and in many industries. This coherence is a welcome development, for some of the earlier volumes were open to criticism on the score of inconsistency. Ten years ago *Decorative Art* seemed to give little lead, in its choice of illustrations, on the real trends in the minor arts of furnishing and decoration.

The picture is very different to-day and probably for the reason brought out in the editors' introduction, namely pressure on space in modern living. In their own words 'furniture to-day has really come to grips with the terms and timbre [*sic*] of the sort of lives that most people live'. The result in this book is a selection of modest, small scale pieces with a strong family likeness, no matter what the country of origin. The same international character is evident in the other sections dealing with pots and glass, cutlery and textiles. As you flip through these pages it is hard to say who did what, the general impression being one of Scandinavian elongation and economy.

It would perhaps be more interesting next time to see the book divided nationally rather than industrially, so that what variations there are between countries could be more easily identified. It would also be interesting to read, as introductions to such national chapters, short statements of opinion contributed by leading critics of their own country's work. Even on the present editorial plan there is room for further comment at the beginning of each section to point the trends or to explain the selections.

It would be good, too, to see a much stronger section on domestic architecture. The present treatment of this subject seems altogether too haphazard and too limited in scope to give any useful perspective. Indeed the opening page on a house on the outskirts of Berlin seems so far out of step with the rest of the book that one is inclined to guess that the editors included these pictures just because they happened to arrive on their desks. This section needs much firmer, more convinced handling, because it is only against the background of modern architecture that the developments in other fields make sense.

But let us hope none the less that *Decorative Art* will continue to thrive and to appear year after year from its new stable in Fleet Street, for there can be few better sources of reference for the student of design in everyday things.

PAUL REILLY

MODULOR 2. *By Le Corbusier. London, Faber*, 1958. 42*s net*

It is probably due to the confusion between Modulor and Modular that I was asked to review this book. Recently, for example, *Prefabrication* carried a subheading 'The Modulor Society', and the R.I.B.A. Library List recorded this book as *Modular* 2. The confusion is a nuisance to all concerned. Le Corbusier (p. 135) complains of the Modular Society adopting a name 'in all fairness too similar to the Modulor'. This complaint is less than honest. 'Modular co-ordination', as the term to describe the co-ordination of building components in reference to a single fixed dimension, had been internationally current for at least 10 years before 1942, the year in which he says he invented the Modulor. He was well aware of this, for he publishes in *Modulor* 2 his correspondence on this subject with the French Standards Institution in that year. In 1942 also, there was published in France the French Standard on modular co-ordination. This was seven years before *Le Modulor* was first published. It is the arrogance of genius to appropriate public property to itself and then accuse the rest of us of stealing from him!

What, readers may ask, is this Modulor? The name is a contraction of Module d'Or. It is the Golden Ratio based upon a fixed dimension and extended both ways to infinity. The scale of sizes thus defined is to be used by architects and industrial designers. The Golden Ratio has, of course, been known to mathematicians and

designers for more than 2,000 years: the use of a module for defining architectural proportions has been practised for even longer. Le Corbusier's 'invention', upon which he preens himself in mystic phraseology throughout p. 17, and elsewhere, consists in basing the Golden Ratio upon the fixed dimension of his ideal man who is 6 ft. tall.

Is there a conflict between this and the modular co-ordination of building components on the International Module of 4 in./10 cm.? No such conflict is necessary. Le Corbusier (p. 88) accuses modular co-ordination of dullness. Of course, it is dull: it has a modest pedestrian job to do. It is beneath the level at which systems of proportion such as the Modulor (there are many others) are to be applied. Many of us use such systems superimposed upon the basic unit of the module, many others have no confidence in these aids to design. The fact that the basis of the Modulor, 6 ft., is also a modular dimension shows that there is not only no conflict, but the possibility of coincidence between the two, if the passionate believers in the Modulor will allow.

More than half of *Modulor* 2 is filled with expressions of effusive praise from users and admirers of the Modulor—an extended publisher's blurb strung together by the author. These lesser men seem to fancy that the Master's designing tool will, in mystic fashion, endue their own work with something of his genius. He himself makes it clear that he believes in no such thing, although he relishes their admiration.

The latter part of the book contains, half-obscured by the continuous tone-poem of Le Corbusier's literary style, many side-lights upon his method of designing. (There is also a recapitulation of the geometrical construction of the Modulor.) These indications ought to dispel some of the illusions. Here is what he says:

> The moduloric rhythm becomes secondary. (P. 173.)
>
> But, of course, the Modulor came in at the moment of partitioning the window area and its *brise-soleil*. (P. 217.)
>
> . . . geometrical, manifested by the square ; textural, by the Modulor . . . (P. 231.)
>
> I am, in principle, against 'modules' when they curtail the imagination. (P. 251.)
>
> The Modulor has never conferred imagination upon those who do not possess it. (P. 279.)

MARK HARTLAND THOMAS

THE GOLDEN NUMBER. *By M. Borissavlievitch. London, Tiranti,* 1958. 15*s net*

'The present book is but a short and incomplete summary, made in connection with the Golden Number, from Borissavlievitch: *Traité de l'Esthetique Scientifique de l'Architecture.*' These are the closing words of the book, and the author has, in fact, to refer the reader frequently to the longer work, which is not published in England.

It is perhaps this which makes the book baffling to the reader. Many of the diagrams are too small to be read without the use of a glass, the letters and figures on them are not always referred to in the text, and the arguments are in many cases incomplete.

Borissavlievitch is discussing proportion and its application to architectural design. He condemns mathematical methods of proportioning buildings, contending that when these proportions are seen, under the influence of perspective, they no longer appear as the proportions which the architect built into his design. Later in the book, however, the author himself makes use of geometrical constructions (esp. Figures 96 and 97), and when demonstrating his 'Law of the Similar' and 'Law of the Tympanum', he uses two-dimensional geometrical constructions superimposed upon *perspectives* of buildings (Figures 64 and 100)! He is thus in the position of being able to 'prove' almost anything he wants, by making a suitable alteration in the position of the eye in the perspective layout.

This is again the case in Figure 98, text page 82, where a method of determining the height of a pediment is given. A movement of the eye along the Principal Visual

Ray will immediately alter the proportions of the pediment. These apparently grotesque errors could have a meaning were the constructions used as a basis for optical corrections according with the most probable position of the viewer. The author does not mention such a possibility in this connection.

Nevertheless, some of the constructions made by means of the 'Law of the Similar' are impressive when appied to the determination of the heights of entablatures, pediments and pedestals, though, tantalisingly, the full working is not given.

Borissavlievitch's correction of the Arch of Titus is equally impressive, though it is interesting to note that the line which he gives for the top of the building is inherent in Umbdenstock's regulating diagram, which Borissavlievitch condemns, along with all other regulating diagrams.

The 'Law of the Similar in Perspective' would, in fact, seem to be a real contribution to the study of proportion in elevations. It is not detrimental to the power of the method which Borissavlievitch here (again only partially) expounds to point out that though he claims his method to be 'optico-physiologically' correct, the Brunelleschian Perspective, upon which it is based, gives only a conventional approximation to visual appearances.

The impression left by the book is that it contains a number of very interesting, though only partially-explained ideas, jostling with much of what appears, perhaps through over-condensation, to be loose thinking.

Perhaps Messrs. Tiranti might persuade M. Borissavlievitch to write a clearly-expounded and well-illustrated book upon the 'Law of the Similar' alone.

RICHARD HILEY

EIGHTEENTH-CENTURY GERMAN PORCELAIN. *By George Savage. London, Rockliff,* 1958. 3 *guineas net*

The publisher's claim that this is 'the first English work to give a comprehensive review of the history of all the German factories' cannot be sustained. This addition to the scanty English literature of the subject, however, may be welcomed as competent and useful. It tells the story of the spread of the porcelain cult in Germany from the time when Meissen was in unique and proud possession of the *arcanum* to the transformation of this essentially baroque-rococo art into an industry towards the end of the eighteenth century. The larger factories are treated satisfactorily, but the information given concerning some of the lesser manufactories leaves something to be desired. The reader will not be much wiser after reading the following:

> The factories of Schney and Tettau in Bavaria were founded late in the century. They are unimportant, and their products during the period under review were few in number. They are represented in the Bayerisches National-museum.

Nor will a visit to the Bayerisches Nationalmuseum necessarily be more rewarding, for Mr. Savage is at pains to explain that he has not been able to check the present whereabouts of things which he describes in the present tense as being in German museums.

The chief interest of this book is in the information Mr. Savage provides concerning owners and patrons, artists and modellers, pastes, glazes, styles and patterns. German words abound, but Mr. Savage usually provides an English equivalent or translation, and always makes his meaning clear. He is not afraid of taking an independent line. Concerning the Meissen gold *chinoiseries*, Mr. Savage differs, rightly I think, from the late W. B. Honey, but his argument is marred by faulty plate and footnote references.

The best chapters in Mr. Savage's book are those on Meissen and Vienna, Nymphenburg and Frankenthal. The work of the chief artists and modellers is described with a wealth of detail. Mr. Savage has interesting observations to make

about the effect on Kändler's later modelling of the failure of his ambitious project, the great equestrian statue of Augustus III, upon which he lavished so much of his time and talents.

Kändler was prolific of ideas, and his 900 to 1,000 models sum up the first, and for many people the most significant, phase of European porcelain production. Kändler's interpretations of Italian comedy characters are, I think, unsurpassed and rarely equalled in quality by those of any other German factory. He enters into the ribald spirit of the *lazzi*, the humorous and suggestive 'stage business' which enlivened the improvised Italian comedy (marvellously interpreted in the etchings of Callot), in a way that Bustelli, for example, was apparently never able to do and, for this reason (his wide range of subjects and his never-failing creativeness are others), Kändler seems greater than the other outstanding eighteenth-century ceramic modeller, Bustelli, excellent as are some of his figures.

Bustelli, however, is very much a vogue of recent years. Those who saw the assembly of Bustelli Italian comedy masterpieces in the 'Baroque Art of Bavaria' Exhibition at the Victoria and Albert Museum a few years ago, if unmindful of Kändler's prolific and often superlative work, may well endorse Mr. Savage's opinion, '. . . in Bustelli Nymphenburg boasted a modeller who could, at his best, outshine Kändler himself'.

Mr. Savage illustrates a large number of porcelain figures which afford interesting comparisons of individual as well as period styles. He is hard on Auliczek, whose vigorous animal models he does not like and describes as sadistic, but these are surely to be preferred to the dumpy-looking, half-naked wench shown on plate 82*b* or the statuettes emblematic of the Continent. I suppose Auliczek at Nymphenburg was so completely outclassed by Bustelli that it is difficult to do justice to him.

Here then is a book which provokes thought and discussion. It is well produced, provides plentiful and often very good illustrations covering a wide range of articles and factories, and is satisfactorily indexed. A selection of marks is also provided, but I noted the omission of good recent books in English by George Ware, Siegfried Ducret and Yvonne Hackenbroch from the book list.

REGINALD G. HAGGAR

FROM THE JOURNAL OF 1859

VOLUME VII. *11th March*

ON COLOURING STATUES

[On Wednesday, 4th March, Professor Richard Westmacott, R.A., F.R.S., had read a paper 'On Polychromy in Sculpture, or Colouring Statues', in which he examined, and dismissed, the argument that the ancients had habitually coloured their sculpture.]

SIR,—I had hoped to have been present at Professor Westmacott's reading on Wednesday last, and to have produced at the meeting two specimens of image painting—statuettes, neither of them, perhaps, of the highest art, yet sufficient to illustrate the argument of how these matters should be treated with colour. One was a porcelain Shepherd, bedaubed with red, yellow, and blue, being intended for the decoration of the homes of the humbler classes; the other a 'Bergerette', of the Watteau School, in Dresden china, painted in the most delicate manner; a pleasing object, certainly improved by colour, and an ornament worthy of the most elegant boudoir.

The one was glazy, ugly, and coarse; the other delicately soft and sweet, perhaps maudlin in sentiment, but yet enough to show that isolated specimens of refined or classic sculpture ought never to be painted in primitive colours, but rather be

tinted or stained, so as to permit of the texture and transparency of the stone being seen. Indeed, in wholly nude or heroic figures, the pure untouched material ought to suffice, any aid tending to sensualize, destroying that lofty conventional tone so essential to the highest works of art.

Of figures, either upon pediments or otherwise, in connection with architecture, it is somewhat different: in the classic, tinted backgrounds may aid outlines, and in later styles positive colours be used with great effect, as numerous painted altars and tombs will testify—then rather in juxtaposition with the picturesque or irregular than the simple and severe.

That the English school of sculpture—like that of painting—should become remarkable for its colour, is not, I think, to be desired, as it would decidedly tend to destroy the little appreciation of form it has. I do not say that in isolated cases slight colour may not aid, but there are many in which it would deteriorate, as may be seen by the figures over the windows of St. James's hall (Mr. Owen Jones's effective interior), where both from size and tinting the poor individuals elevated there look like specimens of impaled humanity, *sans couverture*. Of the attempt to colour the Panathenaic Frieze, all who run to Sydenham may read about the degradation of the divine work on Phidias, and learn what to touch and what to avoid. Certainly, the great works of the antique artists, having beauties of their own totally independent of place or time, never stood in need of a coat of paint—the very idea of the *Laocoon* or the *Farnese Hercules* painted or tinted being simply comic.

I am, &c.,

JOHN LEIGHTON

Some Activities of Other Societies and Organizations

MEETINGS

WED. 25 FEB. Fuel, Institute of, at Institution of Civil Engineers, Great George Street, S.W.1. 5.30 p.m. Dr. Ing. Heinrich Lent : *Problems of air pollution in Germany.*

Kinematograph Society, British, at Royal Society of Arts, John Adam Street, W.C.2. 7.30 p.m. T. C. Macnamara : *Television picture reproduction.*

Radio Engineers, British Institution of, at London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1. 6.30 p.m. E. Dennis Swann : *Patents and the radio engineer.*

THURS. 26 FEB. The Chemical Society, at The Royal Institution, Albemarle Street, W.1. 7.30 p.m. Professor F. Hoyle : *The origin of the elements.*

FRI. 27 FEB. Mechanical Engineers, Institution of, 1 Birdcage Walk, Westminster, S.W.1. 6 p.m. Informal discussion : *Choice of gas temperature and steam and pressure conditions in nuclear power stations.*

SAT. 28 FEB. Horniman Museum, London Road, Forest Hill, S.E.23. 3.30 p.m. G. R. G. Worcester : *African sculpture and western art.*

TUES. 3 MARCH. Economics and Political Science, London School of, Houghton Street, Aldwych, W.C.2. 5 p.m. G. Tugendhat : *The economics of energy.*

WED. 4 MARCH. Victoria & Albert Museum, S. Kensington, S.W.7. 6.15 p.m. Helmut Gernsheim : *Aesthetic trends in photography, 1834–1939.*

THURS. 5 MARCH. Refrigeration, Institute of, at 76 Mark Lane, E.C.3. 5.30 p.m. Ir. T. van Heile : *Applications of refrigeration to horticultural produce in the Netherlands.*

SAT. 7 MARCH. Interplanetary Society, British, at Caxton Hall, Westminster, S.W.1. 6 p.m. Dr. W. T. Blackband : *Radio communication with a space probe.*

MON. 9 MARCH. Engineering Designers, Institution of, at 6 Higham Place, Newcastle-upon-Tyne 1. 7.15 p.m. H. Cullen : *The development of Calder Hall.*

Engineers, Junior Institution of, at 44 Union Street, Sheffield 1. 7.30 p.m. Paper : *Paper-making machines.*

Transport, Institute of, at 66 Portland Place, W.1. 5.45 p.m. David Blee : *The future of British Railways.*

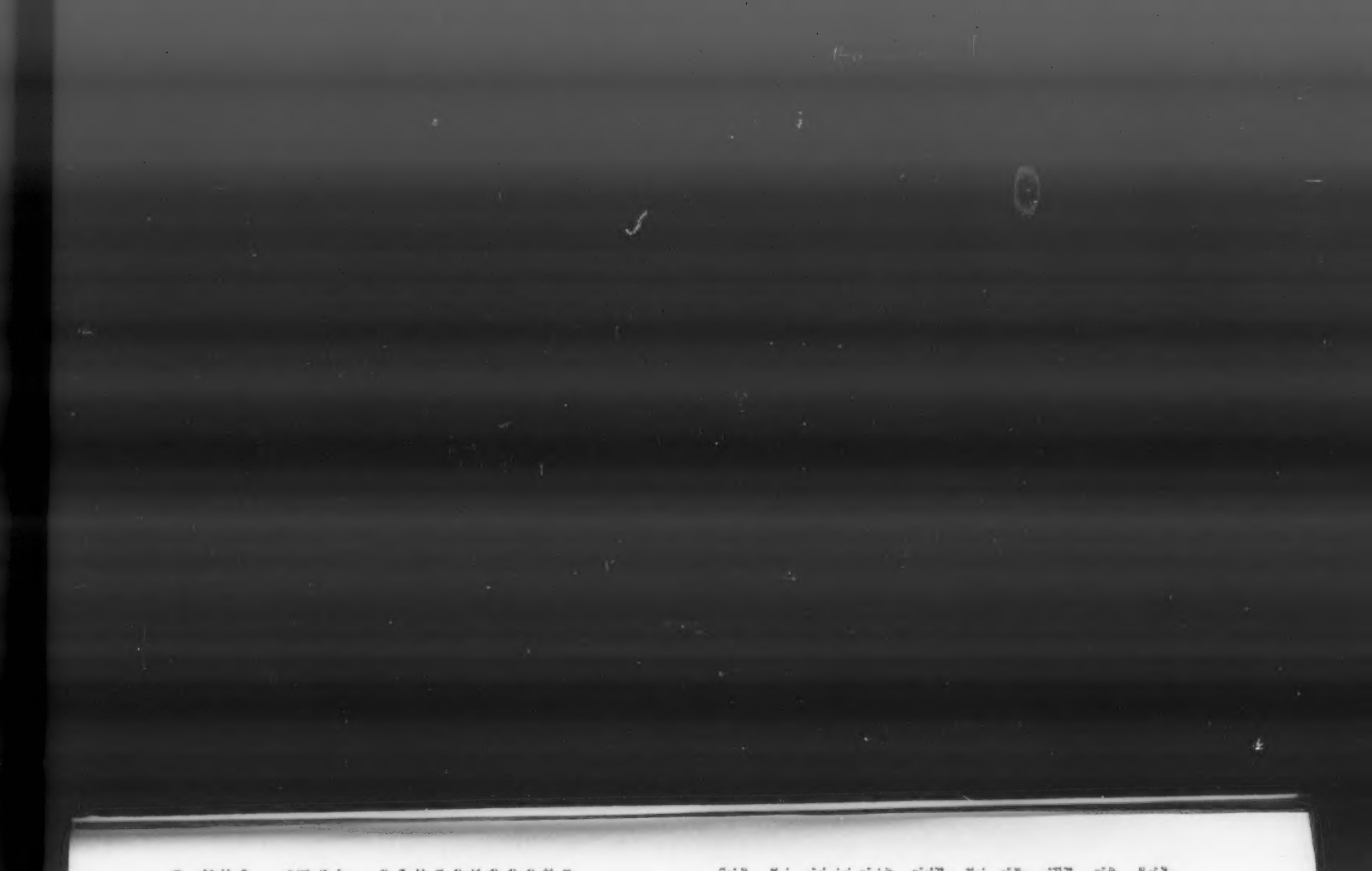
TUES. 10 MARCH. Mechanical Engineers, Institution of, 1 Birdcage Walk, Westminster, S.W.1. 6 p.m. K. E. W. Ridler : *The rôle of the petroleum industry in world car development.*

WED. 11 MARCH. Engineering Inspection, Institution of, at Royal Society of Arts, John Adam Street, W.C.2. 6.45 p.m. Dr. A. D. Merriman : *Application and inspection of transistors.*

THURS. 12 MARCH. Antiquarian Horological Society, at The Science Museum, S. Kensington, S.W.7. 7 p.m. W. J. Gazeley : *The lever escapement.*

Public Health Engineers, Institution of, Caxton Hall, Victoria Street, S.W.1. 6 p.m. R. L. Brown : *Facts about air pollution from homes and factories.*

TUES. 17 MARCH. Architects, Royal Institute of British, 66 Portland Place, W.1. 6 p.m. Bryan P. Westwood and Professor S. R. Sparkes : *Hostels, Hotels and Motels.*

WED. 18 MARCH. Electrical Engineers, Instutition of, Savoy Place, W.C.2. 5.30 p.m. C. W. Oatkey : *New amplifying techniques.*

THURS. 19 MARCH. Road Transport Engineers, Institute of, at Royal Society of Arts, John Adam Street, W.C.2. 6.30 p.m. Superintendent H. Gilder : *The functions of a traffic department in a police force.*